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Report and documentation of the

INTERNATIONAL WORKSHOP ON THE IMPLEMENTATION OF INTERNATIONAL FISHERIES INSTRUMENTS AND FACTORS OF UNSUSTAINABILITY AND OVEREXPLOITATION IN FISHERIES

Mauritius, 3–7 February 2003

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PREPARATION OF THIS DOCUMENT

With financial support from the Government of Japan, an FAO project, GCP/INT/788/JPN, was initiated in 2001 to address issues related to factors of overexploitation and unsustainability in fisheries. The aim of the project is to improve fisheries management through better knowledge of factors leading to unsustainability and overexploitation in fisheries, and to improve the framework for the implementation of international fisheries instruments.

A first workshop on factors contributing to unsustainability and overexploitation in fisheries was organized in the context of this project in Bangkok, Thailand, from 4 to 8 February 2002 ("the Bangkok Workshop").[1]

A second workshop on the implementation of international fisheries instruments and factors of unsustainability and overexploitation in fisheries was held in Mauritius, from 3 to 7 February 2003 ("The Mauritius Workshop").

This document contains the report of the Mauritius Workshop, discussion papers containing eleven case studies and notes submitted to the workshop by participants. This document, and in particular the conclusions adopted by workshop participants, will serve as a basis for further analytical work aimed at improved fisheries management and a more effective implementation of major international fisheries instruments. Such work will be pursued in 2003, and the final aim of the project is the organization in 2004 of a major international conference on factors of unsustainability and the effective implementation of international fisheries management instruments.

The document was compiled and edited by Ms Judith Swan, Consultant, and Dr Dominique Gréboval, Senior Fishery Planning Officer (FAO Fisheries Department) and Technical Secretary of the Workshop.

Distribution

Participants in the Workshop
FAO Fisheries Department
Fisheries Officers in FAO Regional Offices

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[1] The report of the Bangkok Workshop is published in FAO Fisheries Report No. 672, "Report and documentation of the International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries, Bangkok, Thailand, 4-8 February 2002", Gréboval, ed.

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ABSTRACT

An international workshop was organized in order to identify factors of unsustainability and overexploitation in fisheries and review major issues in the implementation of international fisheries instruments. The workshop referred closely to the results of a first workshop held in Bangkok in 2002 (*The International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries*). It aimed more specifically at answering the following three major questions: What are the major obstacles to the implementation of major legal instruments? What are the main lessons learned and the possible paths to solutions for improved implementation? What are the possible gaps that may exist in these instruments to guide the international community in improving the management of marine fisheries?

The workshop was based on a review of eleven case studies, each relating to one of the following categories of fishery: large volume small pelagics; tuna and tuna-like species; large volume demersals; and coastal fisheries.

This document contains the report of the workshop, discussion papers containing case studies and notes submitted to the workshop by participants. This document, and in particular the conclusions adopted by workshop participants, will serve as a basis for further analytical work aimed at improved fisheries management and a more effective implementation of major international fisheries instruments.

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INTRODUCTION

This is the second workshop in a project that aims at improved fisheries management through better knowledge of factors leading to unsustainability and overexploitation in fisheries, and an improved framework for the implementation of international fisheries instruments. The project, GCP/INT/788/JPN: *Factors of Overexploitation and Unsustainability in Fisheries* was initiated in 2001 by FAO with financial support from the Government of Japan against a background of increasing concern for the rapidly deteriorating state of our marine fisheries.

Over the last 15 years, the marine fishery resources of the world have been increasingly subjected to overexploitation, detrimental fishing practices, and environmental degradation. The phenomenon now affects a majority of fisheries worldwide, with very severe consequences in terms of resource unsustainability, massive economic waste, increasing social cost and food insecurity.

Over the last decade, the international community has become increasingly aware of this situation. At the global level, a number of major legal instruments have been developed to address the management of marine fisheries. Among these are: the 1995 FAO Code of Conduct for Responsible Fisheries, the 1995 UN Fish Stocks Agreement and more recently the International Plan of Action for the Management of Fishing Capacity and the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing. Regional fisheries management organizations have also been strengthened, with a number of new ones having been created in recent years.

Yet the effective implementation of these instruments appears to be a slow and difficult process. There is seldom an international fisheries forum that does not call for increased determination to implement these instruments to halt and eventually reverse the present trend of resource depletion. This call was renewed recently in Johannesburg at the World Summit on Sustainable Development. However, effective implementation of the instruments is difficult because, *inter alia*, the factors contributing to fisheries overexploitation and unsustainability are still not widely understood.

The first workshop, *The International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries*, was held in Bangkok, 4-8 February 2002 ("the Bangkok Workshop").[1] It was attended by 24 experts, in their personal capacity, from a wide range of countries, disciplines and experience.

The Bangkok Workshop focused on identifying main factors of unsustainability (and to some extent, how they interact) and possible paths to solutions. The main factors identified and used by the present workshop as a sound basis for analysis, were: inappropriate incentives; high demand for limited resources; poverty and lack of alternatives; complexity and lack of knowledge; lack of governance; interactions of the fishery sector with other sectors and with the environment. The workshop also reviewed the adequacy of major existing international fisheries instruments. An Analytic Summary of the Bangkok Workshop appears in Annex 3 of the report in this document.

The present workshop, *The International Workshop on the Implementation of International Fisheries Instruments and Factors of Unsustainability and Overexploitation in Fisheries* was held in Mauritius, 3-7 February 2003. It was attended by 31 experts from 23 countries, in their personal capacity, representing diverse expertise, backgrounds and nationalities.

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[1] The report of the Bangkok Workshop is published in FAO Fisheries Report No. 672, "Report and documentation of the International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries, Bangkok, Thailand, 4-8 February 2002", Gréboval, ed.

The workshop was based on a review of eleven case studies, each relating to one of the following categories of fishery: large volume small pelagics; tuna and tuna-like species; large volume demersals; and coastal fisheries. The aim was to identify issues and obstacles for fishery management (with reference to the factors of unsustainability identified at the Bangkok Workshop), lessons to be learned and paths to solutions. This was achieved in the context of four dimensions of sustainability: bio-ecological; social; economic; and institutional. Special attention was given to policy considerations related to priorities for fishery management and conservation. The Analytical Framework used as a basis for the case studies appears in Annex 4 of the report in this document.

Four working groups were formed; one for each of category of fishery, to review and further consider the issues raised in the discussion papers containing the case studies. Each working group presented a general report and conclusions to plenary and plenary arrived at general conclusions applicable to all categories of fishery.

In general, this workshop concluded that poor governance is a major cause for the inability to achieve sustainable fisheries. Other issues addressed in the conclusions are: the need to grant secure rights to resource users; a widespread need for capacity building, training and other specified forms of information dissemination and sharing; the need to extend the usual focus of fishery management beyond the biological component so that economic and social components (the latter considered to be insufficiently covered by fisheries management instruments) are also considered; a need for better progress at national and regional levels in implementing international instruments; and how a lack of will often impedes the achievement of sustainability.

This document contains the report of the Mauritius Workshop, discussion papers containing case studies and notes submitted to the workshop by participants. This document, and in particular the conclusions adopted by workshop participants, will serve as a basis for further analytical work aimed at improved fisheries management and a more effective implementation of major international fisheries instruments. Such work will be pursued in 2003, and the final aim of the project is the organization in 2004 of a major international conference on factors of unsustainability and the effective implementation of international fisheries management instruments.

PART I : REPORT OF THE INTERNATIONAL WORKSHOP ON THE IMPLEMETATION OF INTERNATIONAL FISHERIES INSTRUMENTS AND FACTORS OF UNSUSTAINABILITY AND OVEREXPLOITATION IN FISHERIES

1. INTRODUCTION

The *International Workshop on the Implementation of International Fisheries Instruments and Factors of Unsustainability and Overexploitation in Fisheries* was held from 3 to 7 February 2003 in Mauritius. The workshop was organized in the context of an FAO trust fund project (Project GCP/INT/788/JPN: *Factors of Unsustainability and Overexploitation in Fisheries*). It was hosted by the Government of Mauritius.

The workshop was attended by 31 experts, in their personal capacity, from 23 countries representing a wide range of disciplines and experience. Two observers and members of the FAO Secretariat also attended. A list of participants appears in Annex 1.

The Technical Secretary of the Workshop, Mr Dominique Gréboval, welcomed participants in the name of the Assistant Director General of FAO for Fisheries, Mr Ichiro Nomura, and thanked the Government of Mauritius for hosting the Workshop. He recalled that the objective of the Workshop, building on the results of a workshop held in Bangkok in 2002, is to identify factors of unsustainability and overexploitation in fisheries and review major issues in the implementation of international fisheries instruments. He noted that the Workshop will refer closely to the six major factors of unsustainability identified in the Bangkok Workshop, but will aim more specifically at answering three major questions, based on case studies to be presented:

- What are the major obstacles to the implementation of major legal instruments?
- What are the main lessons learned and the possible paths to solutions for improved implementation?
- What are the possible gaps that may exist in these instruments to guide the international community in improving the management of marine fisheries?

He also stated that related work will be pursued in 2003, and that the final aim of the project is the organization in 2004 of a major international conference on factors of unsustainability and the effective implementation of international fisheries management instruments.

The Workshop was opened by Hon. Sylvio Louis Michel, Minister of Fisheries of the Government of Mauritius. He recalled that fisheries overexploitation and unsustainability have been a major concern for fisheries managers and policy makers for at least half a century, and referred to the international instruments that have been developed to address the concerns. The Minister noted that while some States have made considerable progress in implementing the instruments, others are still facing difficulties in the identification of factors contributing to fisheries overexploitation and unsustainability, thus leading to problems in implementation. He identified illegal, unreported and unregulated (IUU) fishing as a major problem of unsustainability, and described how it has become a delicate balancing act, in respect of coastal near shore resources, to ensure the livelihood of the many artisanal fishers. He noted the progress made by Mauritius in relation to these issues.

Mr Rognvaldur Hannesson was acclaimed as Chair of the Workshop. The agenda adopted by the Workshop appears in Annex 2. The Technical Secretary of the Workshop, Mr Dominique Gréboval, recalled that this workshop would build on the results of the Bangkok Workshop, referring to the factors of sustainability identified at that workshop: inappropriate incentives; high demand for limited resources; poverty and lack of alternatives; complexity and lack of knowledge; lack of governance; interactions of the fishery sector with other sectors and the environment. An Analytic Summary of the Bangkok Workshop appears in Annex 3, including a full description of these factors and paths to solutions.

Mr Gréboval reviewed the framework of the Workshop, stating that 11 case studies would be presented and discussed in plenary, then further examined by one of the following working groups: large volume small pelagics; tuna and tuna-like species; large volume demersals and coastal fisheries.

The case studies were prepared according to an analytical framework that appears in Annex 4. It is based on the factors of unsustainability identified at the Bangkok Workshop, and contains the following key questions to be used as a framework for the paper.

- Is fishery management achieving the four components of sustainability: bio-ecological, economic, social and institutional?
- Why is fishery management successful or not?
- Paths to solutions - how can difficulties and obstacles be overcome?

The Chair invited participants who had prepared discussion papers to present them to plenary, and presided over brief discussions subsequent to each presentation. A fuller discussion of the issues raised in the papers took place in the relevant working group.

A summary of each discussion paper follows below in section 2 of this Part. The conclusions of the Workshop, reached after discussion in working groups and review by plenary, are in section 3 of this Part.

2. SUMMARY OF DISCUSSION PAPERS

Following is a summary of each discussion paper presented in plenary. The full papers appear in Part II of this report, and notes prepared by some Workshop participants appear in Part III

2.1 Large volume small pelagics

2.1.1 Large volume small pelagics in the southeast Atlantic

David Boyer presented a discussion paper on large volume small pelagic fisheries of the south-east Atlantic, specifically Angola, Namibia and South Africa. He noted that Namibia's fisheries management system incorporates many of the accepted best-practices as outlined in the major international fisheries conventions. The South African management system is very similar, while, owing to several decades of civil war, the Angolan system is still in the early stages of development. Despite the similarity in the management systems of South Africa and Namibia, Namibia's sardine and anchovy stocks are in a severely depleted state, while, in contrast, South Africa's stocks are fully recovered. Furthermore, in addition to having an acclaimed management system with generally effective control and enforcement, the Namibian bio-ecological system is also seemingly conducive to successful fisheries management. The system contains relatively few species and is clearly defined, with few shared or straddling stocks. The state of the Namibian small pelagic stocks clearly indicates that current fisheries management systems are not effective at managing highly variable and dynamic fish stocks and it is therefore concluded that external effects also play a significant role. Until these are understood, and incorporated into management policies, unsustainable fisheries are likely to recur.

2.1.2 Management of the small pelagic fishery in Chile

Alejandro Zuleta V. presented a discussion paper on the management of the small pelagic fishery in Chile. The fishery was described, and bioecological, economic, social, and institutional factors of unsustainability were examined. The discussion of each factor provided a historical perspective, and then concluded with a description of the positive actions that show that the administration has fully comprehended the aims of management that promote fisheries sustainability. This was followed by a description of the obstacles that must be overcome in order to continue advancing. The main factors associated with unsustainability were identified and a list of the actions was presented that could contribute to improving the sustainability of the small pelagic fisheries in Chile.

2.2 Tuna and tuna-like species

2.2.1 Biological overview of tuna stocks overfishing

Alain Fonteneau presented a discussion paper on the biology of tuna, noting that tuna resources have been classified by scientists and lawyers as highly migratory species. Six tuna species constitute the group of "major tunas" that are heavily fished by various industrialised countries and targeting the two main markets for tunas, namely canneries and sashimi. The major tuna are the two species of bluefin (*Thunnus thynnus* and *Thunnus thynnus maccoyii*), yellowfin (*Thunnus albacares*), skipjack (*Katsuwonus pelamis*), bigeye tuna (*Thunnus obesus*) and albacore (*Thunnus alalunga*). World catches of these tunas have been showing a steady increase during the last half century. This positive trend could suggest that tuna stocks worldwide are not yet overfished. The status of the various tuna species and stocks world wide is compared, discussing their present rates of exploitation in relation to their potential overfishing. The serious difficulties faced by scientists world wide to estimate the real status of tuna stocks and their overfishing risks is also discussed. Past and potential problems of by-catches by the various tuna fisheries and the collateral potential effects of tuna fisheries on the pelagic ecosystems are also discussed, knowing that these effects could have serious negative impact on various tuna fisheries.

2.2.2 Tuna management

Judith Swan presented a discussion paper on tuna management. The background of tuna management through regional tuna fishery management organizations (RTFMOs) was reviewed, acknowledging that, due to the highly migratory or mobile nature of tuna, management is best carried out throughout the range of the species, taking into account principles and provisions in recent international instruments. It was noted that while there has been a recent surge in development of national tuna management plans, activity has mainly been centred in the tuna-rich Pacific Island States of the Western and Central Pacific, in preparation for the establishment of the Western and Central Pacific Tuna Commission. General obstacles to management of tuna by RTFMOs were outlined, and issues and priorities for tuna management recently identified by the RTFMOs themselves presented, such as the need for more information and data, problems associated with IUU fishing and tuna trade. Steps being taken by RTFMOs to address specific management issues were described, including measures to implement recent international fishery instruments, develop catch certification and trade schemes and improve cooperation and coordination at regional level. Some paths to solutions were suggested, building on current initiatives and noting that this is a period of consolidation for the implementation of international instruments.

2.3 Large volume demersals

2.3.1 Evaluation of British Columbia rockfish fishery

Jake Rice presented a discussion paper on the multi-species rockfish fishery in British Columbia. This fishery combines many of the greatest challenges of multi-species tropical fisheries with the technology and institutions of developed-world Northern Temperate fisheries and management. An evaluation within the framework set by the Bangkok workshop was presented, together with the history of the fishery and rationale for the conclusions.

2.3.2 Large volume demersal fishery in the North Atlantic

Jean-Jacques Maguire presented a discussion paper on large volume demersal fisheries in the North Atlantic. It was noted that these fisheries have been conducted for centuries in the North Atlantic, and fisheries science and science-based fishery management can be said to have originated in this area for the management of large volume pelagic and demersal fisheries. Yet, despite its long history and the large investments in fishery science and in fishery management, most large volume demersal fisheries in the area have severely overexploited the resources and stocks are seriously depleted. None of the fishery management systems reviewed can be described as achieving sustainability under any of the four components of sustainability. It is hypothesised that an exclusive focus on the bio-ecological component of sustainability may be at least partially responsible for the failure of fishery management in the area.

2.3.3 Gulf of Thailand trawl fisheries

Ratana Chuenpagdee presented a discussion on the Gulf of Thailand trawl fisheries. She noted that the Gulf of Thailand (GoT) has long been overfished – a well-known fact that shapes many of the fisheries policies developed by Thailand's Department of Fisheries (DoF). In general, Thai Government endorsed numerous international treaties and conventions and regional fisheries agreements. The DoF also developed policies that largely correspond to those that are accepted within the global fishery management community, and which are related to bio-ecological, social, economic and institutional components of sustainability. Except for the banning of trawl within 3 km of shoreline, these measures are far being from effective in protecting and restoring the fisheries resources of the GoT. She concluded that the problems with trawl fisheries in the Gulf of Thailand continue, including excess cumulative fishing capacity, and a declining catch per unit effort, and "trash fish" constituting the bulk of the catches, notably because they are not followed by implementing legislation and enforcement (and the corresponding budget allocations). Moreover, they often exacerbated existing conflicts between large-scale and small-scale fishers. Overall, the difficulties and obstacles for management of the trawl fishery in the GoT are due to inappropriate incentives, absence of policy implementation, poverty in fishing communities, and lack of alternative employments for fishers.

2.4 Coastal fisheries

2.4.1 Coastal fisheries in Italy

Massimo Spagnolo presented a discussion paper analysing, on the basis of coastal fisheries in Italy, management procedures and tools within the four components of sustainability. Difficulties and obstacles in the management of trawler and polyvalent trawler fisheries targeting demersal, crustaceans and molluscs stocks were considered. The four dimensions of sustainability were reviewed as part of the management process and factors affecting the achievement of policy targets are identified. Paths to solutions were addressed with a view to assessing the level of difficulties limiting the achievement of a sound management fishery policy in a context where stocks have been considered in an acceptable shape for a long time.

2.4.2 Coastal fisheries in the Mediterranean region

Alain Bonzon presented a discussion paper addressing Mediterranean fisheries with a focus on institutional issues at the regional level, especially on factors related to limited governance. The role and recent achievements of the General Fisheries Commission for the Mediterranean (GFCM) toward promoting the implementation of international instruments were reviewed. Effective coordinating policies and activities of the relevant institutions concerned within the multi-level governance context of the Mediterranean, was particularly emphasised.

2.4.3 West African coastal and small scale demersal fisheries

A discussion paper prepared by Stephen Cunningham, Boubacar Ba and Sidi el Moctar ould Iyaye on West African coastal and small scale demersal fisheries was presented by Guèye Ndiaga. It considers the difficulties and obstacles met in particular by States (rather than regional organizations) in implementing existing fisheries instruments, the way that these difficulties might be overcome, the lessons that have been learnt and the gaps which continue to exist. The paper draws on the experience of Mauritania and Senegal. Given the nature of the terms of reference, the paper focuses extensively on problems. This approach is not intended to be critical of the fisheries policy adopted by the two countries but rather to focus on areas where improvement appears possible. In both cases, fisheries policy has evolved substantially in the appropriate direction in recent years and the hope is that this paper may highlight some areas where it is possible to build on the progress achieved so far.

2.4.4 The case of developing countries

Philippe Cacaud presented a discussion paper on developing countries. It was noted that an increasing number of developing countries have adhered to international fisheries instruments over the past few years. Implementation of these instruments is a formidable challenge for the fisheries authorities of these countries, which in most cases suffers from a lack of human and financial resources. Application of the four components of sustainability shows that developing countries have, so far, been unable to translate fisheries management principles into effective management actions. Lack of good governance in all dimensions of fisheries management was identified as the principal obstacle to achieving sustainability. It was argued that unless this issue is addressed, it would very difficult for developing countries to improve significantly the effectiveness of fisheries management.

3. CONCLUSIONS OF WORKSHOP

3.1 Introduction

Case studies, prepared according to an analytical framework based on the report of the Bangkok Workshop and an examination of international instruments, were presented in plenary. The framework identified the aims of fishery management under the bio-ecological, economic, social and institutional components of sustainabilty as they appeared in the fisheries instruments. The case studies covered the following fisheries:

- large volume small pelagics;
- tuna and tuna like species;
- large volume demersals;
- coastal fisheries.

Four working groups were formed to identify issues and obstacles, lessons to be learned, and paths to solutions for each specific fishery. The issues and obstacles could be grouped into the six factors of unsustainability identified at the Bangkok Workshop. These were:

- lack of good governance[2];
- inappropriate incentives;
- high demand for limited resource;
- poverty and lack of alternatives;
- complexity and lack of knowledge;
- interactions of the fisheries sector with other sectors and environment.

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[2] The working definition being used within FAO for fisheries governance is: "A continuing process through which governments, institutions and stakeholders of the fishery sector – administrators, politicians, fishers and those in affiliated sectors – elaborate, adopt and implement appropriate policies, plans and management strategies to ensure resources are utilized in a sustainable and responsible manner. It could be at global, regional, sub-regional, national or local levels. In the process, conflicting or diverse interests may be accommodated and cooperative action may be taken". Workshop participants considered civil society to be included among the stakeholders of the fishery sector, in addition to the above listing. The reference to "lack of governance" by the Bangkok Workshop was amended by this Workshop to "lack of good governance".

The fisheries-specific conclusions of the Workshop, based on the reports of the working groups, appear in section 3 below ("Fishery-Specific Conclusions of the Workshop"). The full report of each working group is in Annex 5.

3.2 General conclusions

The Workshop noted the following common conclusions that emerged from plenary discussion and the working groups' reports, and identified these as significant to addressing unsustainability for all fisheries.

- Poor governance is a major cause for the inability to reach sustainable fisheries. Failure to have good governance, in itself, is sufficient for fishery management to fail.

- There is a need to grant secure rights to resource users (individually or collectively) for use of a portion of the resource, space, or other relevant aspect of the fishery. Inappropriate incentives and lack of good governance are often predominant issues preventing sustainability and both link to the absence of secure rights.

- There is a widespread need for capacity building, training, education, awareness building, and sharing of knowledge relevant to fisheries management for all stakeholders.

- Fishery management has usually focused primarily on the bio-ecological component of sustainability, but has often failed even on this dimension of sustainability, possibly because it did not pay enough explicit attention to the other components of sustainability. Achieving sustainability requires a blend of a conservation perspective and the social and economic perspective of those directly associated with the fisheries. Either alone will not succeed. The social component of sustainability is insufficiently covered by fisheries management instruments in general.

- There is a need to make better progress in the implementation of international instruments relating to sustainability at the national and regional levels;

- Achieving sustainability is often impeded because there is a lack of will to make management decisions or because decisions that have been made are not enacted either due to a lack of will or a lack of capacity to act on them.

Each working group considered that the relative importance of the various factors of unsustainability varied according to the type of fishery under consideration. Further, the working groups considered that the linkages and interactions between the factors of unsustainability were highly complex and had not been fully addressed. It is often the failure to take into account the interactions between the factors that have impaired past management attempts.

3.3 Fishery-specific conclusions of the Workshop

3.3.1 Large Volume Small Pelagics

Large volume small pelagic species are characterized by large natural variations in abundance, both at the annual (through variations in recruitment levels) and decadal scales (through regime shifts). This requires an adaptable management strategy that deals with the risk and uncertainty inherent in these fisheries. The industry, in terms of fishing and processing capacity, and labour, should also be sufficiently malleable and versatile to deal with large variations in catches.

Small pelagic species are often key-stone species affecting the sustainability of other fisheries and the ecosystem in general. It is therefore especially important in this sector that ecosystem functioning is understood and that ecosystem considerations are taken into account in management.

Governance issues are similar to those in other types of fisheries, in particular limited legitimacy and a lack of capacity. The application of incentives (especially exclusive rights), provision of sufficient resources (both financial and human), development of assessment tools and reference points, and the implementation of management strategies are important, and these must be appropriate to cope with the large changes in abundance that occur in these stocks. In addition, large volume small pelagic stocks are often migratory, and hence are shared stocks, both internationally and nationally. They usually occur close to the shore and are harvested by fleets of different scales. Relevant research is needed and management arrangements need to be implemented to prevent conflict between countries and sectors, and to ensure sustainability.

3.3.2 Tunas and tuna-like species

Tuna fisheries exploit the highly migratory species listed in the 1982 UN Convention that occur both on the high seas and in areas under national jurisdiction and therefore, require international management. Tuna represent a high proportion of the value of the world fish catch. Tropical tunas typically have a short life history and high reproductive potential, and, with the exception of the bigeye tuna the stocks are considered to be resilient to overexploitation. Temperate tunas typically have a long life and reproduce at an advanced age, in well defined breeding areas, and are highly vulnerable to overexploitation. The high market demand and high price for bluefin tunas cause a dangerous increase in the fishing effort.

All oceans will shortly be covered by regional tuna fisheries management organizations (RTFMOs), some of which have been in existence for half a century. These bodies are supported by well organised data collection and science mechanisms and have the power to adopt decisions binding on their members. Their assessment of stocks is nevertheless still facing major scientific uncertainties and there remain problems with data reliability for some fisheries. Moreover, while the focus of these bodies is on resource management, their mandate most often does not enable them to address economic, social or ecological issues. Further, not all tuna fishing entities are members of the relevant RFTMO.

Nevertheless, the group identified a wide range of factors of unsustainability, the most important of which related to weaknesses in governance at both regional and national levels, arising notably from: lack of political will or capacity of contracting parties; non-cooperation of important fishing States and fishing entities; and high impact of IUU fishing. Serious difficulties were also identified with respect to the allocation of catches and quotas, including on the high seas. Interactions between different fisheries (purse seiners vs. longliners; purse seiners vs. small scale fisheries) were also identified as a factor of unsustainability, as was the complexity of the tuna fisheries and the related eco-system. The Group observed that tuna fisheries were characterized by a high potential fleet mobility between oceans, which requires the regional organizations to coordinate their efforts and activities to work towards harmonised fisheries management measures. The implementation of the FAO Compliance Agreement, in particular the listing of high seas fishing vessels, was also considered important in this regard. Finally, the high price of some products, inappropriate incentives and poverty were thought to constitute significant factors of unsustainability.

3.3.3 Large Volume Demersals

Large volume demersal fisheries are generally characterised by industrialised fishing fleets targeting a relatively small number of species in a large but delimited area, for commercial marketing. However, there is still substantial diversity within this class of fisheries. This diversity means that neither problems nor paths to solutions would be considered to apply universally across them all.

Some of these fisheries have substantial organization and supporting science and management infrastructure which should facilitate achieving sustainability. Nonetheless, failures of fisheries management in such fisheries have been common. The biology and status of resources and the control of harvest rates have been the primary focus of research and management efforts. Nonetheless, failures to achieve sustainability are as great as or greater on this dimension than on any of the others. To achieve sustainability of these fisheries requires a blend of a conservation perspective and the social and economic perspective of those directly associated with the fisheries. Either alone will not succeed.

Inappropriate incentives and lack of good governance are by far the predominant issues in this fishery, both links to the absence of secure rights. There are many types of rights, and a great need exists for more economic and social science research on the fishery and fishers, rather than just the fish, in order to understand what form of rights is appropriate in any particular case. Resource users are a very good source for ideas on how to solve their own problems, and many management structures do not make enough use of bottom up strategic planning and institutional participatory management processes. However, when there are serious conflicts among sectors, these must be resolved before rights and responsibilities can be fully assigned, and top-down intervention may have a crucial role in this case.

3.3.4 *Coastal Fisheries*

Coastal fisheries include subsistence, large - scale and small - scale commercial and recreational fisheries. These fisheries can harvest a large number of species using a variety of fishing gears or they can target one or a few species with a single gear. These fisheries are typically characterised by complexity in one or several of their characteristics and spatial structure is generally important. The obstacles and paths to solutions vary according to the type of coastal fisheries.

Lack of good governance is an important factor of unsustainability for coastal fisheries. Measures to address this issue will vary with the specific case, but are likely to include at least some of: establishing community-based management, providing adequate and appropriate access rights to legitimate[3] fishers, fishing communities, or organizations, strengthening and coordinating various levels of organizations and institutions, and promoting education and awareness on basic fisheries management, leadership, compliance, and law enforcement. Many of these measures will also address issues related to inappropriate incentives.

Most existing resource assessment and fishery management tools are not appropriate to address the spatial scale, diversity, and complexity of coastal fisheries. Some coastal fisheries appear to have been managed at least as successfully as simpler large-volume, more industrial fisheries where successful fishery management was considered more likely. However, many coastal fisheries remain a major fishery management challenge because of their linkages to other coastal activities, other fisheries and ecological systems (open systems), and their spatial structure. These characteristics may cause considerable difficulties in all aspects of management, including monitoring and assessment of the resources and of the fisheries, the development of effective harvesting strategies, as well as in enforcement, control and surveillance. There is a need for innovative research and approaches to management exploring different tools and strategies integrating scientific and traditional knowledge.

Integrated approaches to policy, planning and resource management need to be considered as important tools for fisheries management itself, and to facilitate interactions between fisheries and other sectors in the coastal areas. In this context, fishery management should be seen as an adaptive process that needs to be iteratively fine–tuned.

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[3] The definition of a legitimate fisher will vary from one fishery to the other. A legitimate fisher is one that is recognized and managed as such by the management system.

ANNEX 1

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ANNEX 2

WORKSHOP AGENDA

Monday, 3 February 2003

Morning:	Opening Ceremony
[Plenary]	Election of Chairperson
	Introduction to the Workshop
	Background to review of factors of unsustainability
	Presentation of the analytical framework used for case studies
	Summary presentation of case studies on large-volume small pelagics fisheries; discussion
Afternoon:	Summary presentation of case study on large-volume demersal fisheries; discussion
[Plenary]	Summary presentation of case study on high knowledge situation; discussion
	Summary presentation of case study on developing countries situation; discussion
	Obstacles to the implementation of major international instruments; discussion

Tuesday, 4 February 2003

Morning and afternoon sessions in two groups:

Group work on the implementation of major international fisheries instruments by types of fisheries. Identification of: 1) issues and obstacles, 2) main achievements and lessons learned and 3) paths to solutions

Group 1 will address this question with particular reference to large volume demersal fisheries (1A)
Group 2 will address this question with particular reference to large volume pelagic fisheries 2(A)

Wednesday, 5 February 2003

Morning:	Short presentation of group initial findings; discussion
[Plenary]	Summary presentation of case studies on large pelagics (tuna) fisheries; discussion
	Summary presentation of case studies on coastal fisheries; discussion
Afternoon:	Group work on the implementation of major international fisheries instruments by types of fisheries. Identification of: 1) issues and obstacles, 2) main achievements and lessons learned and 3) paths to solutions

Group 1 will address this question with particular reference to coastal fisheries (1B)
Group 2 will address this question with particular reference to tuna fisheries (2B)

Thursday, 6 February 2003

Morning: Group work (continued)
Short presentation of Group findings

Afternoon: Free

Friday, 7 February 2003

Morning: Presentation of draft summary report; discussion
Drafting of main conclusions and recommendations

Afternoon: Adoption of main conclusions and recommendations
Closing Ceremony

ANNEX 3

ANALYTIC SUMMARY OF WORKSHOP ON FACTORS OF UNSUSTAINABILITY

BANGKOK, 4-8 FEBRUARY 2002

1. INTRODUCTION

There are increasing concerns about the precarious condition of world fisheries. The natural evolution of fisheries seems to lead to overexploitation and fishery collapses have become too frequent, including in areas under active fishery management. The overexploitation of world fishery resources has negative consequences on food security, on the socio-economic well-being of communities dependent on fishing and on the ecosystem. This trend towards unsustainability of fisheries occurs despite the fact that the concept of 'sustainability' of the natural resource base has been implicitly or explicitly present in the fundamentals of fisheries management at least since the 1950s

An FAO project has been designed to explore the factors giving rise to unsustainability. The specific objectives set out in the project document are to establish:

1. What are the key factors contributing to fisheries overexploitation and unsustainability?
2. How do these factors interact?
3. Which are the priority issues in addressing fisheries overexploitation and unsustainability?
4. What are the best practical approaches to address long-term concern of fisheries overexploitation and unsustainability?

The project organised a first workshop in February 2002 to address mostly point 1 and partially point 2 above. In preparation for a second workshop, this document summarises FAO Fisheries Report No. 672, the proceedings of the first workshop. This summary covers the workshop report itself, the background documents prepared for the workshop, and individual contributions made by participants in written form, and included in FAO Fisheries Report No. 672.

2. NATURE OF UNSUSTAINABILITY

This section is summarised mostly from Cunningham and Maguire.

Unsustainability is often equated with overexploitation but, although exploitation is doubtless an important factor, the size of fish resources fluctuates from natural causes and a resource may be threatened even in the absence of exploitation. There are indications ((Baumgartner, Soutar and Ferreira-Bartrina 1992) that large fluctuations in stock sizes occurred prior to significant exploitation by human. These fluctuations may be due to natural cycles mediated through climatic changes. Klyashtorin (2001), after having identified 50-60 years cycles in both fish abundance and a climate index, hypothesised that some species thrive during periods of increasing temperature while others do so during periods of decreases. Given that the hydro-climatic conditions change over time, and that each species has specific requirements in terms of temperature, salinity, oxygen content etc., it is not surprising that the abundance, and even the presence of species varies over time for reasons other than fishing. There is therefore no doubt that climate does cause groundfish and pelagic fish stock abundance to vary. But the relative importance of fishing versus climate remains a subject of intense debate in specific stock collapses. The ecological component of the fishery system is therefore dynamic and ecological sustainability does not mean that resources will not fluctuate and that the species mix will remain constant when climatic conditions do change.

Fishery resources are also vulnerable to external threats from human activities of humans which are not concerned with the direct exploitation of the fish resource itself, but which can cause unsustainability, either deliberately or accidentally. Decision makers may consider that the unsustainability of the fish resource is the price to pay in order to achieve some other benefit. However, too often, no explicit consideration is given to the impact of other activities on the sustainability of the fish resource which ends up bearing the cost of other activities. The fish resources face a number of external threats, even if it is not exploited, including habitat losses from coastal area development and land-based pollution which may originate far inland.

Fishing is often simplistically assumed to be the main cause of fluctuations in stock size, with optimal fishing leading to optimal stock sizes, and excessive fishing leading to depletion. Classical examples in support of this view are provided by the increase in stock size of North Sea demersal stocks due to decreased fishing during the two World Wars, rapid rebuilding of stocks after decreases in fishing mortality associated with extension of jurisdiction by coastal States (off the Canadian East Coast in 1977 and off Namibia in 1990), and by a rapid, but ephemeral, rebuilding of the Northeast Arctic cod stock around the turn of the 1990s. But decreases in fishing mortality do not always results in immediate increases in stock sizes as exemplified by the lack of rebuilding of cod on Georges Bank off New England and off the Canadian East Coast.

3. DEFINITION OF UNSUSTAINABILITY

FAO defines sustainable development as "*The management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. Such sustainable development conserves (land,) water, plants and (animal) genetic resources, is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable*" (Garcia 2000).

Therefore, "*in FAO definition terms, factors of unsustainability include the non-conservation of the resource base and ill-orientation of technological and institutional change. They lead to degradation of the resource base (including genetic resources) and other changes that are technologically inappropriate , economically non-viable and socially unacceptable, resulting in the non-satisfaction of human needs for present and future generations, (based on FAO Council, 1988).*" (Garcia p. 127, Para. 2). Garcia further suggests using past work on sustainability to investigate unsustainability in an analogy with a compass made to indicate the North can be used to go in the opposite direction.

The modern concept of sustainability is seen to have several components. Charles (2001) stresses that "*there is wide recognition of the need to view sustainability broadly; in an 'integrated' manner that includes ecological, economic, social and institutional aspects of the full system*" (p. 186). From bio – ecological and economic perspective, sustainability does not correspond to a unique yield or fishing effort value such as Maximum Sustainable Yield (MSY) or Maximum Economic Yield (MEY) and the corresponding effort. Bio – ecological and economic sustainability can be achieved at any of the fishing effort values on the yield versus fishing effort curve except at the fishing effort corresponding to stock or fishery collapse. Within this modern concept of sustainability, the fishery system should be considered unsustainable when decisions strongly favour one component over the others "*i.e. when the functional rules and constraints of the life-supporting ecosystem or the vital needs of the people are disregarded. The unsustainability signal comes in terms of social stress and unrest or ecological stress and resource collapses.*" (Garcia, in Gréboval 2002 p. 131, Para. 2)

Working Group 1 of Workshop 1 proposed the following definition of unsustainability: "*Unsustainability occurs in a fishery system when it is agreed that there is an unacceptably high risk that the fishery system is currently or will be in some predefined undesirable state. The risk may be aggravated by natural variability. Desirable states, in terms of both human and ecosystem well-being, are defined by society and may change over time.*

Unsustainability encompasses:
(1) Acute unsustainability (i.e. collapse of the resource or of the fishery with catches well below what might otherwise be available and recovery may be difficult, slow or impossible);
(2) Chronic unsustainability (i.e. resource reduced to the point where catches are lower than they might otherwise be, even if these low catches might be maintainable indefinitely); and
(3) Incipient unsustainability (i.e. if present practices are continued there is an unacceptable risk that the resource will become acutely or chronically unsustainable)."

4. MAIN FACTORS OF UNSUSTAINABILITY

The background paper prepared by Cunningham and Maguire (in Gréboval 2002) identified important factors of unsustainability and how various management approaches mitigated or amplified the effect of the various factors. At the Workshop, Working Group 1 structured its work in relation to a list of typical methods used in fishery management and how the importance of unsustainability factors varied according to geographic strata, while Working Group 2 based its analysis on the Pressure State Response (PSR) framework of analysis. The geographical consideration of the unsustainability factors described the shape of the importance of the factor from the coast to the high seas. A flat shape meant that there was no geographical component to the factor, a decreasing shape meant that the factor lost importance as the fishery was located further from shore, an increasing importance meant the opposite, and a U shape meant that the importance of the factor was higher close to shore and on the highs seas, but lower in – between.

Inadequate governance, ineffective management controls (including Illegal, Unreported and Unregulated (IUU) fishing), and uncertainty were all considered to have a U – shaped influence. Poverty, lack of alternative employment, low opportunity costs, external threats of harm to the ecosystem, and inadequate risk management were considered to have decreasing importance as the fisheries occurred further from the shore. Other factors of unsustainability were considered to have equal importance regardless of the distance from the coast where the fishery occurs. The factors of unsustainability in the Pressure component of the PSR framework are largely economic (excess fishing capacity, asymmetric entry/exit, market pressures, absence of long term view) and social (no alternative livelihoods, demographic pressures, and poverty). Unsustainability also arises from management and institutional aspects (ineffective and no conflict resolutions). Climatic changes, uncertainty and variability in resources are factors of unsustainability in the bio-ecological dimension.

Working Group 2: Participants were asked to identify the three most important factors of unsustainability for each component of the Pressure State Response framework. The average scores were calculated by weighing individual scores by the rank (1 for 1, 0.5 for 2 and 0.3 for rank 3). The following two paragraphs are extracted from FAO Fisheries Report No. 672, page 15 summarise the results.

"*Under the State component of the PSR framework, the main factors of unsustainability are related to the management and institution (ineffective institutions, insufficient monitoring, control and surveillance, insufficient information for decision making and implementation, unclear access conditions, absence of rights, etc.) and to the economic aspects of the fishery system (technological innovations, overcapacity, subsidies, illegal financial transfers). The bio-ecological factors of unsustainability (stock status, uncertainty, variability, fragility) and the social factors (low public awareness, equity issues) are relatively less important.*

Under the Response component of the PSR framework, the main factors of unsustainability are related to the management and institutions (ineffective management, undefined rights, inappropriate response from the sector) and social (low public awareness, inadequate organization of the sector). Market responses may be a factor of unsustainability under the economics component of the fishery system. No bio-ecological factors of unsustainability were identified in the Response component, but in the discussion it was noted that uncertainty often undermines management".

Factors of unsustainability can be internal to fisheries or external; they may contribute directly to unsustainability, or merely be symptoms of other problems and they may have variable importance depending on the stage of the fishery management process or the jurisdiction where fishery management takes place. However, factors contributing to unsustainability are of a similar nature in almost all fishery systems and jurisdictions, if on a different scale and with variable importance.

The Workshop grouped factors of unsustainability into six general types. The following section regroups the classification of unsustainability factors (page 33) and the related recommendations (page 35-37).

Inappropriate incentives*, including market distortions: Currently, many fisheries operate in response to incentives (economic and others) that promote unsustainable practices rather than sustainable ones. Inappropriate incentives lead to a short-term view and overcapitalization as exemplified by the race for fish. Lack of transparency and participation of fishers in the management system undermines confidence and willingness to support management measures. Participants in fisheries should be given incentives for long-term conservation and efficiency.*

Measures that can give appropriate incentives include: (i) assigning secure rights to shares of fisheries, e.g. in terms of areas, effort units or catch; (ii) using market measures (e.g. certification) to discourage unsustainable fisheries; (iii) allowing all legitimate stakeholders (interested parties) to participate meaningfully in fisheries management including setting objectives, providing input to science, evaluating options and reviewing performance relative to objectives. Meaningful participation will vary geographically and by culture but it should always be transparent and provide full access to information.

High demand for limited resources*: Demand for fish is seen as expanding for most markets, with sustainable supply becoming increasingly limited. Higher prices may result which provide an incentive for further input expansion – generally more so in fisheries that are already overexploited.*

Fisheries policy must address the need to align the capacity of fisheries to the marine resources available. Appropriate incentives will assist in resolving this problem as indicated above. Governments must consider fully and explicitly the role that fisheries are to play in the macro-economics of their countries (inter alia through setting explicit objectives) and ensure that the role they envisage is sustainable in all the dimensions of sustainability. In particular, great care should be taken with policies that focus on increasing quantities produced, given the resource constraints of fisheries. Attention should also be given to the conflict between internal and external demand and food security.

Poverty and lack of alternatives*: Conditions of poverty and lack of employment or livelihood alternatives still occur on a significant scale, particularly but not only, in developing countries.*
Use rights should be designed to satisfy societal views of fairness and equity. Benefits from more efficient fisheries management may be used to create alternative employment opportunities. The fishery cannot be expected to solve the problem of poverty and lack of employment. Inadequate management will only make them worse.

Complexity and inadequate knowledge *(social, economic, bio-ecological): The complexity of many fisheries systems as well as inadequate information and understanding make it hard to identify proper courses of action.*

Fisheries are complex systems with strong and poorly understood interdependencies between social, economic and bio-ecological factors. The knowledge needed to deal with them is largely insufficient. Fisheries authorities should:

- *improve data collection (e.g. fisheries statistics) and fisheries monitoring including systems of indicators;*

- *support sustainable scientific programs for fisheries assessment, formulation of advice, evaluation of policies and management performance;*
- *promote the integration of fishers' and scientific knowledge; and*
- *build capacity for management.*

Lack of (appropriate / effective) governance*: (conflicting objectives, lack of attention, will and authority): The inability to implement required management measures by legitimate authorities (including the absence of appropriate institutions) contributes to unsustainability.*
Consistent with a precautionary approach, participants in fisheries management systems should assess the uncertainties and adopt appropriate measures to address the inter-related risks in the economic, institutional, community and ecological dimensions of sustainability.

Institutional sustainability is a component of the overall concept of sustainability. Fishery management institutions should be appropriately funded, possibly through revenues generated by the fishery itself. Under appropriate conditions, delegation of selected management functions to local institutions can be promoted.

Participation of interested parties at all stages of the management process should be ensured. Fishery authorities should promote capacity building and increased public awareness of the need for conservation and management, including for policy makers and the general public.
Local, regional, national and international fisheries management bodies must be provided with adequate resources for monitoring, control and surveillance (including law enforcement) to fulfil their mandate and functions effectively.

The performance of new and existing management approaches and measures should be evaluated over time in order to assess their effectiveness in achieving the intended objectives and to promote institutional learning.

International financial and technical assistance institutions should ensure that their resources do not contribute towards unsustainable fisheries. This should occur consistently and be harmonized at the various levels of governance.

In areas where fishery management institutions do not exist, e.g. in the High Seas, they should be created by the governments concerned so that all the world's marine areas are managed by management institutions.

Where fisheries management institutions exist (or are created), these should be strengthened sufficiently to be able to play their necessary roles. This strengthening should include, as a minimum, receiving clear legal authority to manage and conserve fisheries resources; receiving both the mandate and the resources to ensure compliance with management and conservation policies and regulations; having effective dispute settlement mechanisms in their legal structure; regular performance evaluation of their policies in achieving their objectives.

Donors and international financial communities should actively promote and assist the participation of developing countries in regional fisheries management organizations so that their participation ensures the achievement of the objectives of those organizations.

Interactions of the fishery sector with other sectors, and the environment*: These factors are in most cases beyond the control of the fisheries sector but need to be better accounted for. Government departments responsible for fisheries must take a lead role in protecting the fishery, the resources, and their habitats, from external threats of pollution and contaminants, habitat damage, etc. and in ensuring that the fisheries sector is recognized as a legitimate user in coastal areas.*

5. PATHS TO SOLUTION

Linked with the above factors of unsustainability and recommendations, the Workshop identified seven types of measures that could be taken to address the factors of unsustainability. These paths to solutions are presented as steps towards sustainability.

- *Rights: The granting of secure rights to resource users (individually or collectively) for use of a portion of the catch, space, or other relevant aspects of the fishery.*
- *Transparent, participatory, management: The granting of a meaningful role to stakeholders in the full range of management (e.g. planning, science, legislation, implementation).*
- *Support to science, planning and enforcement: Providing the resources necessary for all aspects of management of the fishery.*
- *Benefit distribution: Using economic tools to distribute benefits from the fishery to address community and economic sustainability.*
- *Integrated policy: Planning fisheries, including setting explicit objectives that address all the dimensions of sustainability and the interactions among the factors of unsustainability.*
- *Precautionary approach: Application according to FAO guidance.*
- *Capacity building and public awareness rising: Development and application of programmes to better inform policy makers and the public at large about main fisheries issues.*
- *Market Incentives: Using market tools in situations where they are appropriate for addressing factors of unsustainability.*

The Workshop also provided a table listing the main factors of unsustainability in the left hand column and possible paths to solutions in the right hand column.

Main factors of unsustainability	*Paths to solutions (with indicative linkage to relevant factors)*
1. Inappropriate incentives	*Rights (1)*
2. High demand for limited resources	*Transparent, participatory, management (1,2,5)*
3. Poverty and lack of alternatives	*Support – science, enforcement, planning (4,5)*
4. Complexity and lack of knowledge	*Benefit distribution (1,3)*
5. Lack of governance	*Integrated policy (1,3)*
6. Interactions of the fishery sector with other sectors, and the environment	*Precautionary approach (4,6)*
	Capacity building and public awareness building (5)
	Market Incentives (1,2)

6. FISHERY MANAGEMENT INSTRUMENTS

Several international instruments are dealing with aspects of ocean governance. A review is provided by Lodge (in Gréboval 2002). The recommendations relating to the relationship between factors of unsustainability and international fisheries instruments identified by the workshop (p. 40) are reproduced below.

- *International fishery instruments address directly or indirectly many of the factors of unsustainability in fisheries and reveal a high level of consensus at the international level on the factors to be addressed. A major problem is one of failure to implement existing instruments. More guidance and capacity-building activities should be directed at the implementation of international instruments at national, subregional and regional level.*

- *The workshop concluded that the key international fishery instruments would benefit from a more detailed analysis and assessment against a more precisely-defined list of factors of* *unsustainability, but that such a study should also identify specific weaknesses in the current international framework, especially relating to the management of high seas resources (other than straddling and highly migratory stocks) and propose solutions. Among the weaknesses in the current regime identified by the workshop were the problems of effective management of exclusively high seas resources, effective enforcement by the flag State and the effective implementation of internationally-agreed market-related measures.*

- *The workshop noted that the focus of many of the international fishery instruments is on action at the regional level, primarily through regional fishery bodies. In the case of straddling and highly migratory fish stocks, the UNFSA establishes the regional fishery management organization as the primary mechanism through which States should fulfil their obligation to cooperate in conservation and management under the 1982 Convention on the Law of the Sea.*

- *The workshop further noted that some of the existing regional fishery management organizations are ineffective, while others have not yet successfully addressed key factors of unsustainability including those relating to compliance, illegal, unregulated and unreported fishing, effective decision-making, the provision of independent scientific advice in accordance with the standards established in international fishery instruments and the implementation of internationally-agreed market-related measures. Among the specific constraints to the effective operation of some regional fishery bodies are lack of resources and lack of effective participation by members, particularly developing countries. Additional efforts should be directed at addressing these constraints.*

- *In order to promote effective implementation of international fishery instruments at subregional and regional level, the workshop considered it was necessary to strengthen regional fishery bodies to ensure that they:*

  (a) meet the standards established by the relevant international fishery instruments;
  (b) possess the necessary mandates to enable them to address the factors of unsustainability; and
  (c) *are equipped to carry out the functions ascribed to them, including by having an adequate resource base and by providing mechanisms for effective participation in their work by all members.*

7. CONCLUSION

Cunningham and Maguire (in Gréboval 2002) concluded "*that without some form of explicit institutional arrangement, either through local or national institutions, fisheries will progressively become unsustainable, at least under one component. In general, they will become economically unsustainable before ecological unsustainability becomes a possibility, but there are cases of low productivity species (deep water slow growing species) where exploitation rates may increase sufficiently rapidly for the fisheries to remain economically sustainable while being biologically unsustainable. Also, low productivity species may become threatened even as by-catch species.*" Appendix 1 provides a description of the dynamics of overfishing in the absence of management.

Boyer and Hamukyaya (in Gréboval 2002) provide an informative account of the development of the orange roughy fishery in Namibian waters showing that fishery management is not always a guarantee that sustainability will be achieved. "*Assessment and management created a paradoxical situation whereby state-of-the-art assessment and modelling yielded high quality advice, yet the fishery virtually collapsed within a very short time. There was close cooperation with industry at all stages. A number of strategies for dealing with uncertainty were incorporated into the stock assessment, including a Bayesian approach, and management process, and attempts were made to apply the precautionary approach. In addition, adaptive management was applied through institutional learning. As a result* *there should be some lessons to be learned from the assessment and management of orange roughy in Namibia. Some aspects provide good examples of how a new developing fishery should be managed; others are clearly illustrative of procedures to be avoided. In particular, one of the main reasons why the management of orange roughy failed to prevent stock collapse was underestimation of some of the uncertainties, particularly those reliant on basic understanding of the biology and behaviour of orange roughy.*" (Boyer and Hamukyaya p. 148, Para. 1).

Cunningham and Maguire (in Gréboval 2002) believe that the almost exclusive focus on bio-ecological sustainability probably contributed to the perceived limited success of fishery management. Fishery management was expected to rebuild all stocks of predators and preys to their optimal sizes and maintain them there. This was overly ambitious and it neglected the possible impact of climatic variability (whether natural or induced by human activities), multispecies and ecosystem effects. They suggest that it could be preferable to act on those components of sustainability where fishery management is likely to have a more direct effect, i.e. the socio-economic, community and institutional components.

McConney (in Gréboval 2002) supports this view and suggests (p. 151) that "*Emphasising human individual, institutional and societal flexibility and adaptation to change, whether humans or other components of nature cause the change, can provide alternatives to rigid or mechanistic perspectives on sustainability. First, humans could be seen as more integral than external to ecosystem models. Ecosystem and human system integration is implicit in holistic treatment of sustainability. Achieving sustainability of fisheries-based livelihoods, for example, may well lead to rational short-term over-exploitation of fisheries resources with the expectation of medium to longer-term recovery to sustainable levels. This may not be bad in some specific cases and for certain fishery resources, but it seems much worse if the ecological and human systems are seen as separate, and perhaps conflicting.*"

"The institutional arrangements with the highest probability of avoiding the three components of unsustainability are those involving meaningfully interested parties in the decision-making process but also in the implementation, and to develop an appropriate incentives structure. Command and control approaches have, therefore, limited potential outside of very specific situations. Therefore, co-management appears a promising approach, whatever method of management (technical conservation measures, input controls, overall output controls, use rights, market measures) is chosen." (Cunningham and Maguire 2002, p. 80).

Modern fishery management has become closely associated with harvest control rules, in a control theory context. Saila (1997) notes that although "*conventional control theory has been a tremendous success where the system is very well defined, such as in missile and space station guidance*" the theory is perhaps not appropriate to control complex systems such as commercial fisheries because the precise structure of the system is virtually unknown and that there are no reliable models of the process to be controlled. Consistent with McConney above, he suggests that success in fishery management requires a system that can handle qualitative information and uncertainty, in a straightforward, transparent and not computationally intensive manner. This is not the direction in which most fishery management processes are heading.

The final paragraph of Cunningham and Maguire summarise the problem succinctly: "*No fishery management system aims at unsustainability. Yet, it is rarely possible to avoid all of its components: when ecological unsustainability is avoided, it is often at the expense of the other components, and vice-versa. Does this mean that all fisheries are going to eventually become unsustainable under some or all of the components of sustainability? Or is unsustainability a normal statistical expectation of the fishery management system failing some of the time? Is a given percentage of unsustainable fisheries a normal feature of a given fishery management system due to the slowness of the control and feedback mechanisms?*"

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APPENDIX

UNSUSTAINABILITY DYNAMICS WITHOUT MANAGEMENT

There are several reasons why fisheries management may not be in place. In early stages of the fishery the reason may be that no problems emerged which may have called for management. However, the more typical situation is that management institutions are weak. The institutions may lack capacity to produce the knowledge required, to resolve conflicts and have decisions made or to implement management measures through monitoring, control and surveillance or other law enforcement measures. Such weaknesses may apply both to individual partners in management (government, fishing industry and communities, other interested parties) and to the institutions through which they interact.

Several driving forces may motivate people and capital to move into the fisheries sector. Markets, available fisheries resources and technological opportunities may enable investments in the sector to produce a profit which is above the expected profit for alternative investment opportunities. Likewise, poverty or low incomes in other sectors may be such that labour expects to be able to produce a higher income in the fisheries sector than elsewhere, whether in kind or in cash.

These higher relative returns in the sector will, if there is no management, put pressure on the sector by attracting capital and labour into the fisheries. This increase in capacity results in higher exploitation of the resource that leads to a reduction in the resource biomass. In terms of economics this results in lower catches relative to the invested capital and applied labour, and thus lower returns. As a side effect, increased capacity will lead to increased environmental impacts in terms of by-catches and impacts on the habitat. Furthermore, as the resource is being more exploited, uncertainties about its state and productivity may increase and environmental variability will result in larger variability.

Lower returns will motivate the fisheries to compensate by expanding the market (expanding market volume, finding higher value markets), reducing relative costs through technological innovation or to expand the resource base by exploiting other resources. If such means are effective in maintaining relative returns above what is expected in other sectors, the influx of capital and labour is expected to continue. The results of this process will, if unchecked, result in recruitment-overfishing that eventually may lead to the stock being depleted or even collapse. In this process, the relative economic returns will become so low that the industry basically is unviable. This will create conflicts among users and increased motivations for bad practices.

Alternative income sources for specialised labour may not be available and investments are locked in vessels with a long investment horizon. The situation may, therefore, be that labour and capital remain for a long time in the fisheries even at relative rates of return which are considerably lower than returns in other sectors. This lack of exit options perpetuates and aggravates the overexploitation and the deterioration of the economy of the sector.

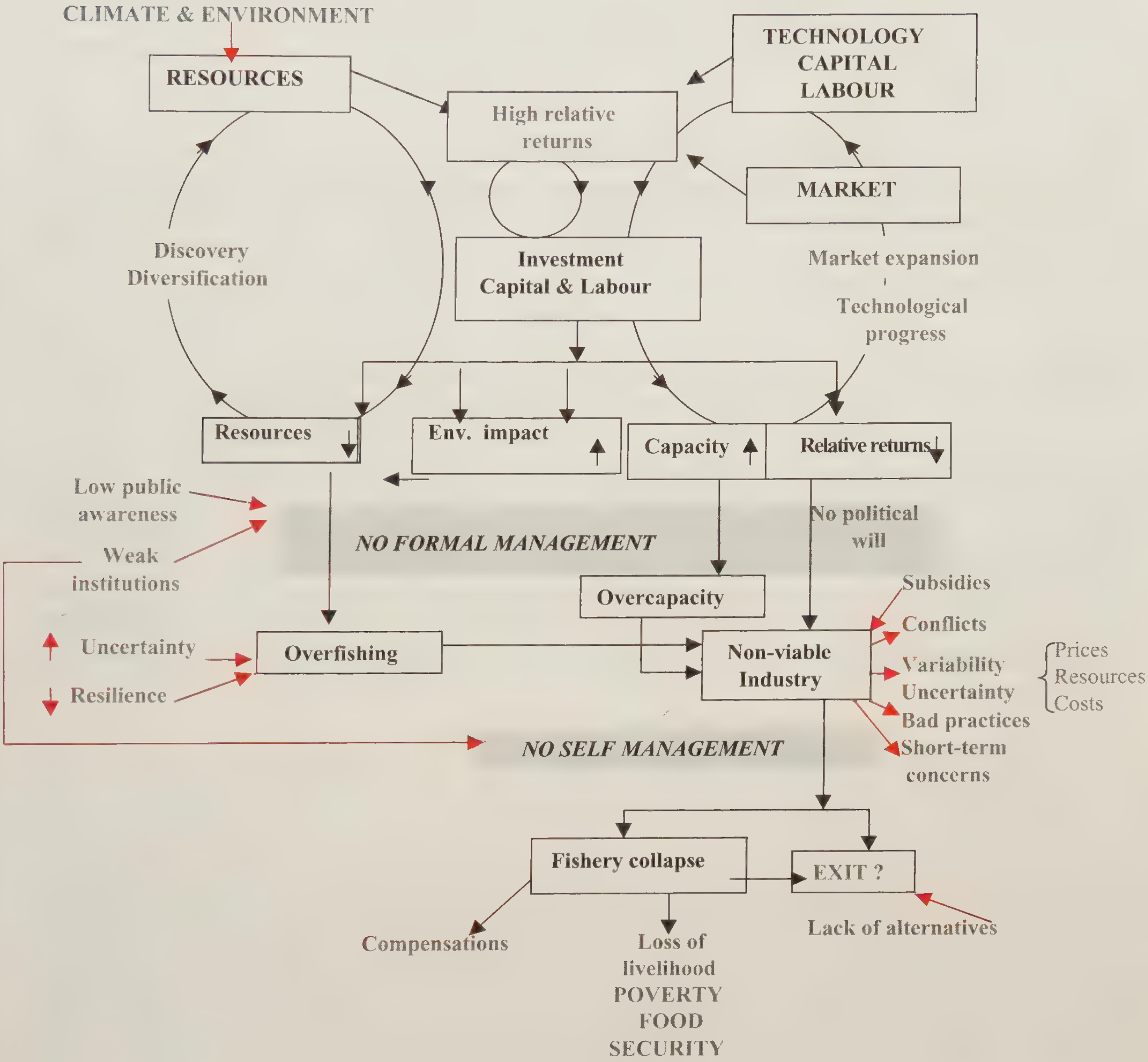
CLIMATE & ENVIRONMENT
RESOURCES
TECHNOLOGY
CAPITAL
LABOUR
High relative returns
MARKET
Discovery
Diversification
Investment
Capital & Labour
Market expansion
Technological progress
Resources
Env. impact
Capacity
Relative returns
Low public awareness
Weak institutions
NO FORMAL MANAGEMENT
No political will
Overcapacity
Subsidies
Conflicts
Uncertainty
Overfishing
Non-viable Industry
Variability
Uncertainty
Prices
Resources
Costs
Resilience
Bad practices
Short-term concerns
NO SELF MANAGEMENT
Fishery collapse
EXIT ?
Lack of alternatives
Compensations
Loss of livelihood
POVERTY
FOOD
SECURITY

Figure 1: Dynamics of unsustainability under NO MANAGEMENT option

ANNEX 4

ANALYTICAL FRAMEWORK FOR THE REVIEWS TO BE PREPARED FOR THE SECOND WORKSHOP ON FACTORS OF UNSUSTAINABILITY

1. INTRODUCTION

In preparation for the second workshop on Factors of Unsustainability, reviews will be prepared to analyse how the main aims of fishery management, as embodied in international instruments, interact with sustainability in various fisheries. Consistent with the first workshop (Bangkok, February 2-4, 2002 - FAO Fisheries Report No. 672), the framework considers four components of sustainability: bio-ecological, social (includes community sustainability), economic, and institutional.

The reviews will cover types of fisheries rather than focus on geographical aspects. However, it is recognised that the two aspects may get confounded (i.e. some type of fisheries only occur in some areas). Each review will briefly describe the main characteristics of the fishery.

Relevant articles of the UN Convention for the Law of the Sea (UNCLOS), Chapter 17 of Agenda 21 (Agenda 21), of the UN Agreement For The Implementation of the Provisions of the United Nations Convention on The Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA), the FAO Code of Conduct for Responsible Fisheries (CCRF), the FAO Compliance Agreement, the International Plans of Actions for the Management of Capacity (IPOA-Capacity) and on Illegal, Unreported and Unregulated Fishing (IPOA-IUU) were reviewed. The main aims identified are presented in the following section.

2. MAIN AIMS OF FISHERY MANAGEMENT

2.1 Bio-ecological

The formulations vary from one instrument to the next, but the message is similar. The main bio-ecological aim is to protect, conserve, and restore fishery resources, the environment, the habitat, the ecosystem and the bio-diversity. Overfishing should be prevented, and restoration (of the resource, the habitat, the ecosystem) should target conditions capable of producing the Maximum Sustainable Yield (MSY). Although multispecies and ecosystem concerns were already included in UNCLOS, subsequent instruments placed more emphasis on these aspects, including the protection of bio-diversity. This aim can be found in UNCLOS[4] 61.2, 61.3, 61.4, in Agenda 21 – 17.46a, b, c, e, f, 17.74f, in UNFSA 5a, d, e, f, g, k, and in CCRF 6.1, 6.2, 6.3, 6.6, 6.8, 7.1.1, 7.2.1, 7.2.2, 7.3.1.

2.2 Social

Four main social aims are pursued. The optimum utilisation of the harvested product by maintaining the nutritional value of harvested products and avoiding waste is found in UNCLOS 62.1 and CCRF 6.7. States and regional fishery management organizations (RFMOs) should also ensure safe, healthy and fair working environments and conditions (CCRF 6.17), they should consider aquaculture as a means to promote diversification of income and diet (CCRF 6.19), and they should assist developing countries (Compliance agreement VII).

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[4] The list of instruments for each main aim is meant to be illustrative, not exhaustive.

2.3 Economic

Three principle economic aims have been identified. UNCLOS (62.2) calls for coastal States "to determine its capacity to harvest the living resources" of its exclusive economic zone and to make excess resources available to other States. Implicitly, this is an appeal to match fishing capacity to the productive capacity of the resources, the environment and the ecosystem. Such appeals can be found explicitly in CCRF 6.3, 7.1.8, 7.2.2, in UNFSA 5h, and, of course, in IPOA-capacity paragraph 7, but also in Part. III, section 1 (paragraphs 11 to 15).

The second economic aims include the conduct of trade according to the World Trade Organization (WTO) rules (CCRF 6.14), including the elimination of subsidies (IPOA capacity Part III, sect. II).

States have also agreed to prevent illegally caught fish from reaching their markets (IPOA-IUU paragraph 66)

2.4 Institutional

By and large, the largest number and most diversified aims of the international instruments deal with institutional aspects of sustainability.

The need to use the best scientific information (on resources, the environment, and the ecosystem) appears in almost all instruments while the inclusion of socio-economic studies and the traditional knowledge is more recent. This aim implies the obligation to collect and disseminate statistics, evaluate the cost effectiveness, efficiency, and socio-economic effects of alternative management measures, and the revision or elimination of inefficient or useless measures: CCRF 6.4, 7.2.1, 7.4.3, 7.4.4, 7.4.5, 7.6.7, 7.6.8, UNCLOS 61.5, 62.3, Agenda 21 – 17.46g, 17.74b, UNFSA 5b, j, k, Compliance agreement VI.

The requirement to apply the precautionary approach to conservation and management (including the identification of reference points) was included in UNFSA (5c) and in the CCRF (6.5, 7.5.1, 7.5.3). States and regional fishery management organizations (RFMOs) are required to do monitoring, control and surveillance, in their areas of jurisdiction but also for those vessels flying their flags on the high seas (CCRF 6.10, 6.11, 7.1.7, UNCLOS 62.4, Agenda 21 – 17.46d, UNFSA 5l, Compliance agreement III, IV, IPOA-IUU 9.1), or of foreign vessels using their ports (IPOA-IUU 52). Similarly, States and RFMOs should Cooperate with other States and other RFMOs to promote conservation and responsible fishing (CCRF 6.12, 7.1.3), and to resolve dispute peacefully (CCRF 6.15, 7.3.3, Compliance agreement Art. V, VI,VIII, IX).

States and RFMOs should implement transparent decision making process and involve interested parties (CCRF 6.13, 7.1.2, 7.1.6, 7.1.9).

States and RFMOs should promote the awareness of responsible fisheries through education and training (CCRF 6.16, 7.1.10).

States should duly take into account the interest of their fisheries in planning the multiple uses of coastal areas (CCRF 6.9, 6.18, 7.2.2, UNFSA 5i).

The main aims of fishery management are summarised in the following text table:

Bio – ecological	Social	Economic	Institutional
1. Conserve and restore	1. Optimum utilisation 2. Working conditions 3. Diversification (aquaculture) 4. Assist developing countries	1. Manage capacity 2. Trade according to WTO rules 3. Prevent fish caught in IUU from reaching markets	1. Use best information 2. Apply the precautionary approach 3. Do monitoring, control and surveillance 4. Cooperate 5. Transparent decision-making 6. Promote responsible fisheries 7. Fishery interest in multiple use of coastal areas

3. FACTORS OF UNSUSTAINABILITY

The first workshop identified six groups of factors leading to unsustainability:

1. Inappropriate incentives, including market distortions: Currently, many fisheries operate in response to incentives (economic and others) that promote unsustainable practices rather than sustainable ones.

2. High demand for limited resources: Demand for fish is seen as expanding for most markets, with sustainable supply becoming increasingly limited. Higher prices may result which provide an incentive for further input expansion – generally more so in fisheries that are already overexploited.

3. Poverty and lack of alternatives: Conditions of poverty and lack of employment or livelihood alternatives still occur on a significant scale, particularly but not only, in developing countries.

4. Complexity and inadequate knowledge (social, economic, bio-ecological): The complexity of many fisheries systems as well as inadequate information and understanding make it hard to identify proper courses of action.

5. Lack of governance: (conflicting objectives, lack of attention, will and authority): The inability to implement required management measures by legitimate authorities (including the absence of appropriate institutions) contributes to unsustainability.

6. Interactions of the fishery sector with other sectors, and the environment: These factors are in most cases beyond the control of the fisheries sector but need to be better accounted for.

4. PATHS TO SOLUTION

Paths to solution identified in the Bangkok Workshop are provided below. The factors of unsustainability they could possibly address are indicated in parenthesis.

1. Rights: The granting of secure rights to resource users (individually or collectively) for use of a portion of the catch, space, or other relevant aspects of the fishery (1).

2. Transparent, participatory, management: The granting of a meaningful role to stakeholders in the full range of management (e.g. planning, science, legislation, implementation) (1,2,5).
3. Support to science, planning and enforcement: Providing the resources necessary for all aspects of management of the fishery (4,5).
4. Benefit distribution: Using economic tools to distribute benefits from the fishery to address community and economic sustainability (1,3).
5. Integrated policy: Planning fisheries, including setting explicit objectives that address all the dimensions of sustainability and the interactions among the factors of unsustainability (1,3).
6. Precautionary approach: Application according to FAO guidance (4,6).
7. Capacity building and public awareness rising: Development and application of programmes to better inform policy makers and the public at large about main fisheries issues (5).
8. Market Incentives: Using market tools in situations where they are appropriate for addressing factors of unsustainability (1,2).

The summary of main factors of unsustainability and paths to solutions presented in the report of The Bangkok Workshop is reproduced below:

Main factors of unsustainability	Paths to solutions (with indicative linkage to relevant factors)
1. Inappropriate incentives	Rights (1)
2. High demand for limited resources	Transparent, participatory, management (1,2,5)
3. Poverty and lack of alternatives	Support – science, enforcement, planning (4,5)
4. Complexity and lack of knowledge	Benefit distribution (1,3)
5. Lack of governance	Integrated policy (1,3)
6. Interactions of the fishery sector with other sectors, and the environment	Precautionary approach (4,6)
	Capacity building and public awareness building (5)
	Market Incentives (1,2)

5. FRAMEWORK

For each main aim of fishery management, the reviews will:

- Assess the difficulties and obstacles to effective implementation: is the aim understood? what factor of unsustainability identified in The Bangkok Workshop is impeding effective implementation and how?
- what lessons can be learned from the implementation;
- what instruments are missing;
- how can the difficulties and obstacles be overcome.

To achieve the above, the following structure is proposed:

1. Is fishery management successfully achieving the four components of sustainability?

a. *Bio-ecological component of sustainability*

Does the organization (national/regional/provincial government and or regional fishery management organization) responsible for fishery management understand that its main bio-ecological aim is to protect, conserve, and restore fishery resources, the environment, the habitat, the ecosystem and bio-diversity; that overfishing should be prevented, and that the resources, the habitat and the ecosystems should be restored to conditions capable of producing the Maximum Sustainable Yield (MSY), taking into account multispecies and ecosystem considerations?

What concrete actions substantiate that the organization does / does not understand its main bio-ecological aim?

b. *Social component of sustainability*

Does the organization (national/regional/provincial government and or regional fishery management organization) responsible for fishery management understand that its main social aims are to achieve optimum utilisation of the resource, ensure safe, healthy and fair working environments and conditions, that they aquaculture should be considered a means to promote diversification of income and diet, and that they should assist developing countries.

What concrete actions substantiate that the organization does / does not understand its main social aim?

c. *Economic component of sustainability*

Does the organization (national/regional/provincial government and or regional fishery management organization) responsible for fishery management understand that its main economic aims are to match fishing capacity to the productive capacity of the resources, the environment and the ecosystem; to conduct trade according to the World Trade Organization (WTO) rules, including the elimination of subsidies and to prevent illegally caught fish from reaching their markets.

What concrete actions substantiate that the organization does / does not understand its main economic aim?

d. *Institutional component of sustainability*

Does the organization (national/regional/provincial government and or regional fishery management organization) responsible for fishery management understand that its main institutional aims are to use the best scientific information (on resources, the environment, the ecosystem, on social and economic factors, including traditional knowledge, the collection and dissemination of statistics, the evaluation of the cost effectiveness, efficiency, and socio-economic effects of alternative management measures, and the revision or elimination of inefficient or useless measures); to apply the precautionary approach to conservation and management; to do monitoring, control and surveillance, in their areas of jurisdiction but also for those vessels flying their flags on the high seas or of foreign vessels using their ports; to co-operate with other States and other RFMOs to promote conservation and responsible fishing, and to resolve dispute peacefully; to implement transparent decision making process and involve interested parties; to promote the awareness of responsible fisheries through education and training; and to duly take into account the interest of their fisheries in planning the multiple use of coastal areas. What concrete actions substantiate that the organization does / does not understand its main institutional aim?

2. Why is fishery management successful (or not)?

How are the main factors of unsustainability identified in the Bangkok Workshop (1. Inappropriate incentives 2. High demand for limited resources 3. Poverty and lack of alternatives 4. Complexity and lack of knowledge 5. Lack of governance 6. Interactions of the fishery sector with other sectors, and the environment) interacting with the achievement of the bio-ecological, social, economic, and institutional components of sustainability?

What other factors are impeding the achievement of the four dimensions of sustainability?

What lessons can be learned from the implementation of fishery management?

3. How can the difficulties and obstacles be overcome?

The first workshop concluded that the main problem was not the lack of instruments, but the lack of implementation of existing instruments. Is that statement true for the type of fishery you are reviewing? If not, what instruments are missing?

If there are no instruments missing, how could the main aim of fishery management be better achieved?

How could the paths to solutions identified in the Bangkok Workshop (Allocation of Rights, transparent, participatory, management, support to science, enforcement, planning, benefit distribution, integrated policy, precautionary approach, capacity building and public awareness building, and market Incentives) help to overcome the difficulties and obstacles to successful implementation of fishery management.

If the fishery management arrangement is deemed to be successful, this section could be used to describe how the difficulties and obstacles have been overcome, following a similar approach, i.e. linked to the paths of solution identified in The Bangkok Workshop and identifying any instrument that could be missing.

APPENDIX

TYPES OF FISHERIES

Tunas and large pelagic fisheries: this type of fishery should cover principally the large scale tuna and billfish fisheries by large longliners and purse seiners. These fleets operate in almost all of the world oceans. Fishery management is through a combination of regional fishery management organizations (ICCAT, IATTC, IOTC, CCSBT) and national organizations. The principal component of this review should deal with the fleets identified above, but it should also cover possible interactions under the four components of sustainability of the large vessel fleets on local artisanal and/or recreational fleets.

Large volume small pelagic fisheries: this type of fishery is characteristically conducted by a relatively small number of large vessels, it either has a relatively small by-catch of non-directed species, or can be conducted in such a way that by-catch is minimised. The main gear is the purse seine or mid-water trawling. Such fisheries are found in the Northeast Atlantic (herring, mackerel, capelin, blue whiting), off the coast of West Africa (sardinella) and Southern Africa (sardines and anchovy) and in the Southeast Pacific (horse mackerel, sardines, anchovy), off the West Coast of South America (Chile, Peru). Some fisheries are close to an idealised "single-species" fishery, others exploit a species mix considered and managed more or less as a "single-species" (sardinella), while the sardine-anchovy fisheries exploit a species mix. Although the largest part of the landings is caught by large "industrialised" vessels, there is generally an interaction with smaller scale "artisanal" fleets that catch the same species in waters closer to shore.

Large volume demersals: this type of fishery is at the root of western modern fishery science and fishery management. Bottom trawl predominates, but various other types of towed (Danish and Scottish seines) or fixed gear (gillnet, set lines, hand lines) may also be used. Vessels range from relatively large vessels towing bottom trawls, to nearshore handlining or fixed nets vessels. These fisheries can be more or less single species (hake off South Africa/Namibia), or multispecies (North Sea). Such fisheries are also found in South Atlantic (hake), and in the North Pacific (Alaskan pollock). These fisheries can be multigear and multinational.

Multispecies tropical fisheries: these fisheries are really multispecies and multigear. They are the worst nightmare of "traditional" western modern fishery science: in addition to the diversity of species and gears, there is also a large number of landing areas, with relatively small landings in each landing area, making it difficult, if not impossible to collect statistics. These fisheries occur in South East Asia, off West Africa and off Eastern South America. In these fisheries, it may be illusory to consider bio-ecological sustainability at the scale of individual species.

Reef fisheries: "Reef fish fisheries are extremely diverse, have many users (commercial, artisanal, recreational, and scientific), and vary greatly by location and species. Anglers fish for food, commerce, sport, and trophies. They operate from charterboats, headboats, private boats, and shore while using fish traps, hook and line, longlines, spears, trammel nets, bang sticks, and barrier nets.

Reef fish fisheries are associated closely with fisheries for other reef animals including spiny lobster, conch, stone crab, corals, and living rock and ornamental aquarium species. Nonconsumptive uses of reef resources (e.g. ecotourism, sport diving, education, and scientific research) also are economically important and can conflict with traditional commercial and recreational fisheries.[…] Fishery data collection remains difficult because there are diverse users, and landings are made at many ports.

Fishing pressure has increased with growing human populations, greater demands for fishery products, and technological improvements, such as longlines, wire fish traps, electronic fish finders, and navigational aids."[5]

Shrimp fisheries: the type of shrimp fisheries covered by the review is conducted by trawls with small mesh. They are generally economically profitable, but have an associated by-catch. Cold water shrimp fisheries face problems and challenges that are different from those of tropical shrimp fisheries.

Dataless fishery management: descriptions of this can be found at:

http://www.spc.int/coastfish/Projects/eu/dataless.htm
http://www.spc.org.nc/coastfish/News/Trad/Tradition4.pdf

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[5] Schirripa, M., Phares, P., Harper, D. 1999. Our living Oceans, Unit 8. http://spo.nwr.noaa.gov/unit08.pdf

ANNEX 5

LARGE VOLUME SMALL PELAGICS WORKING GROUP

REPORT

The objective of the working group was to identify the issues and obstacles to sustainability of large-volume small pelagic fisheries in the light of the factors of unsustainability identified by participants in the Bangkok workshop, identify lessons learned and consider possible paths to solutions. The working group reviewed the potential causes of unsustainability at the bio-ecological, economic, institutional and social levels.

Large volume small pelagic species are generally short-lived, shoaling fish that are often harvested in large quantities. These stocks are typically characterised by large natural variations in abundance, and hence catch. This occurs both at the annual and decadal scales through variations in recruitment levels and regime shifts respectively. Small pelagic stocks create additional challenges to management as they are often migratory, and hence are shared stocks, and as they usually occur close to the shore and are harvested by large-scale commercial fleets and small-scale coastal fishers. They are also often key-stone species affecting the sustainability of other fisheries and the ecosystem in general.

Governance issues are generally similar to those in other types of fisheries, in particular regarding the limited legitimacy of many current management strategies and the lack of skilled and trained management and research practitioners. As with many other large-scale commercial fisheries, the application of incentives (especially exclusive rights), provision of sufficient resources (both financial and human), development of assessment tools and reference points, and the implementation of effective management strategies are important. However, these must be able to cope with the large changes in abundance that occurs in small pelagic stocks. This therefore, requires an adaptable management strategy that can deal with the large risks and uncertainties inherent in these fisheries. Similarly, the industry should also be sufficiently malleable and versatile to deal with large variations in catches, in terms of fishing and processing capacity, and labour. The working group considered that one of the key requirements of all sectors of the industry was stability and that this was difficult to achieve given the bioecological dynamics of these types of resources. Nevertheless it was suggested that management strategies should be aimed achieving stability and at mitigating the effects of variations in catch.

It is especially important in this sector that investigations to improve the understanding of the functioning of the ecosystem are conducted and in particular that the consequences of different management strategies are understood. These ecosystem considerations need to be taken into account in management. The current lack of understanding of such processes is a good example of a situation where precautionary management strategies should be applied.

More attention should be given to research to determine the stock structures of stocks that are shared to enable appropriate management arrangements to be developed to maximise the benefits from the resource and achieve optimum utilisation. When several different fleets are targeting the same resource, management arrangements need to be developed to ensure sustainability. This can be achieved through the appropriate division of the resource via allocation of rights, improved MCS, development of clear management objectives and where applicable meaningful co-management strategies.

In identifying the issues and obstacles to sustainability, the working group considered that, in relation to large-volume small pelagic fisheries, the most important factors of unsustainability were complexity and variability, inadequate knowledge, interactions of the fishery sector with other sectors and the environment, and lack of appropriate governance. The working group also considered, however, that the interactions between factors were complex and that many of the issues, obstacles and solutions identified related to more than one of the factors of unsustainability. The following table shows the factors, issues and possible paths to solutions, and the relationships between them, as determined by the working group.

LARGE VOLUME SMALL PELAGIC FISHERIES

RELEVANT IMPORTANCE OF FACTORS OF SUSTAINABILITY IN RELATIONS TO LARGE-SCALE SMALL PELAGIC FISHERIES

Factor		Issues and obstacles	Also	Paths to solutions
1 **Complexity**	a	Large natural variations in abundance Short-lived Environmental fluctuations and regime shifts	2	Better understanding of resource dynamics & availability Adaptive management Develop environmental indices for prediction Manage resources to promote stability of catches Improved research Manage resources regionally Fleet malleability
	b	Migrations across borders making sharing arrangements difficult	2, 3	Manage resources regionally Fleet malleability
	c	Stock and management units not the same	2, 3	Co-operation for research and management
	d	Inappropriate stock assessment methods		Direct surveys Standardization of assessment methodology
	e	Aggregating behaviour (catchability not=abundance decline) with inappropriate perceptions/credibility of stock size		Education/awareness
	f	Small pelagics are often (usually) key-stone species affecting sustainability of other fisheries and ecosystems in general	2	Take ecosystem relationships into account in management Improved research
2 **Interactions**	a	Small pelagics are often (usually) key-stone species affecting sustainability of other fisheries and ecosystem in general	1	See 1f Collaboration between research/management organizations

Factors		Issues and obstacles	Also	Paths to solutions
	b	Large-scale social disruptions, e.g. AIDS, war, poverty	1, 3, 4	Policy and planning to take into account
	c	Increasing demand from agri+ aqua-culture for fish & fishmeal	1	Rights-based fisheries
3 Lack of governance	b	Inequity of fisheries access agreements between developed and developing nations, including overexploitation	1b, c	Development of bilateral/sub-regional arrangements
	h	Lack of co-operation & international governance over shared stocks	1b, c	Explore avenues for formal co-operation, particularly research and MCS
		International co-operation in small pelagics not often perceived as necessary		
		Jurisdiction areas inappropriate	1c	
		Mandates of RFOs do not address the full-range of unsustainability issues		
	a	Conflict between industrial and small-scale fisheries, including focus on industrial sector and lack of information on small-scale sector		Division of resources (rights) Zoning Improved MCS Improved statistics on small-scale fisheries
	c	Lack of equity, disparity of wealth		Policy and planning to take into account
	e	Lack of legitimacy of decision-making process Lack of participation Resistance to co-management Lack of understanding (by fishers) of management concepts Lack of transparency		Explore meaningful co-management strategies Foster responsible behaviour and compliance Appropriate incentives, e.g. rights-based fishery Education/awareness/information sharing Training and capacity building
	d	Lack of support (funding) to institutions	2	Allocation of sufficient resources
	f	Lack of enforcement of decisions (not as critical as other fisheries) By-catch of juveniles, both small-scale and large-volume?		Transparent, participatory management
	i	Lack of NPOAs, conflicting objectives		Develop management objectives, including establishment of appropriate reference points, explicit in NDPs
	g	Lack of research and management capacity for adaptable management to deal with large changes in abundance	2	Allocation of sufficient resources Development of easily detectible indices

Factors		Issues and ostacles	Also	Paths to solutions
	k	Conflict between aims of fisheries and developing agencies leading to over-investment in fishing capacity	1d	Development of appropriate reference points, use of decision-theory (tables) to acknowledge possible state of nature, estimate risk of exceeding limit-reference points with alternative management strategies, development OMPs
	j	National development is measured by increases in fishing capacity -catch and effort not linear		Education/awareness
4 Poverty	a	Labour intensive processing factories, therefore pressures to maintain fishing		Develop management strategies to cope with variability, e.g. emergency assistance funds
	b	Food security		Investigate possibility for adding value to products Use of underutilized species for human consumption (see also 3b) Development of alternatives, e.g. aquaculture
	c	Destructive fishing methods as last resort when fish scarce		Foster responsible behaviour and compliance
5 Inappropriate incentives	a	Loan-decisions based on historical performance not future stock projections		Better information to financial institutions
	b	Subsidies, especially in fully or over-exploited fisheries		Eliminate such subsidies
	c	Salary bonuses demand high catches	4	Assign secure rights
6 High demand	a	High demand for limited resources is not usually a factor, but can be	3a	Promote regional cooperation to use excess capacity
	b	Industry desires stability		Manage resources to promote stability of catches
	c	Large volumes are a requirement in industrial (fishmeal)		

TUNA AND TUNA-LIKE SPECIES WORKING GROUP

REPORT

OBJECTIVES

The objectives of this working group are to:

1. List obstacles to sustainability and identify which are most applicable to small pelagic fisheries
2. Identify possible paths of solutions on the basis lessons learned

REPORT

The tunas are listed as highly migratory species in the 1982 UN Convention and most of them have an extensive distribution on the high seas. Although total catches amount to less than five percent of world marine fish catches, their value has been estimated to amount to nearly one fifth of their total value.

The oceanic tuna species are loosely categorised into the tropical and temperate tunas. They exhibit a wide range of life histories, ranging from the skipjack, which have a short lifespan, high fecundity and wide distribution in tropical seas, to the bluefin tunas which are long lived, breed late and have well defined breeding and migration patterns. In consequence, skipjack are generally accepted to be very resilient to overexploitation, while bluefin are very vulnerable, all the more because of their extremely high market value. The other species tend to be more intermediate.

Because of their wide ranging distribution, tunas require international management. The mandates for regional tuna fisheries management organizations provide for measures that are binding on their members to a varying degree, but their mandates are generally limited to biological aspects of fishery resource management. Some have mandates which cover environmental issues, while few have any economic or social mandate.

However, the pressure by tuna fisheries on these stocks, especially for species of high value, is still increasing. All fishing zones are now actively fished by multiple fleets and gears. It now appears that most or all tuna stocks will soon be facing serious risks of excessive exploitation, unless proactive and efficient management measures are taken in all oceans. This has obliged various tuna Commissions to take proactive management actions. This management should be coordinated worldwide as a wide majority of tuna catches are taken by highly mobile tuna fleets that are able to move quickly between oceans (as was observed in 1984 when the Atlantic purse seine fleet moved massively to the Indian Ocean).

The Working Group (WG) reviewed the potential causes of unsustainability at the institutional bio-ecological, economic and social levels following the factors identified in the Bangkok workshop. These were classified in perceived order of importance, both as regards the factors themselves, and in relation to the issues for each factor. The table below shows the factors, issues and possible path to solutions, together with comments to explain the context of the issues identified.

The first factor of potential unsustainability identified by the Working Group relates to the lack of effective governance. The major issue identified in this field was the lack of real political will expressed by both contracting and non-contracting parties to address management.

Despite the provisions of the UN Fish Stock Agreement, many fishing countries or entities are not yet members of relevant tuna Commissions. Furthermore, in most oceanic areas, increasingly large numbers of IUU vessels are targeting the most valuable tuna stocks (e.g. bigeye or bluefin), without reporting their catch nor taking into account international management and conservation measures adopted for tuna stocks. Furthermore, the existence of these large IUU fleets is often an excuse for some countries member of a regional fisheries organization to postpone the adoption and implementation of management decisions. It was also noted that this lack of willingness to take management actions is reinforced by the present lack of an agreed system for the allocation fishing rights.

Another problem identified as an issue in the governance of most tuna fisheries was the question of resource allocation between developed and developing States. While distant water fishing nations wish to maintain or to develop their fisheries, many coastal developing States show a legitimate will to develop their own tuna fisheries. This situation creates increasing conflicts within the various tuna Commissions, as many tuna stocks are nowadays, either fully exploited or close to be fully exploited. Also identified as a key issue was the vulnerability of some developing States, particularly some small island developing States, which are critically dependent on the exploitation of tuna stocks, including for reasons of food security as well as economic development.

The second factor considered by the WG as being of key importance were the various types of potential interaction involving the tuna fisheries. To the public, the most visible of these potential interactions are probably the by-catches and accidental mortality of sensitive species such as turtles, birds, dolphins and sharks which might lead to closures or restrictions on certain fisheries. Efficient research and active cooperation of fishers could, in most cases, reduce these accidental mortalities.

Another important potential interaction is that between fisheries, involving the long term effects on tuna stocks of purse seine fisheries using Fish Aggregating Devices (FADs), primarily targeting skipjack tunas. Large numbers of juvenile bigeye tunas are often taken under FADs, with the risk of impacting on the catch by the longline fisheries of the far more valuable adults. While the impacts of this interaction are still uncertain and complex to evaluate and predict, there is a global need to reduce the mortality of juvenile bigeye in the FAD fishery.

A third factor is the complexity of tuna stock assessment. Assessments are difficult because of the high mobility of the stocks throughout the oceans and the great depth at which they occur. Uncertainties exist also with regard to the stock structure and the movement patterns (e.g. the proportion of a fish stock moving between various areas). Assessments are therefore, heavily dependent on fishery-related data. Another difficulty faced by all tuna bodies is to estimate the increase of fishing efficiency in tuna fleets world wide.

The dynamics of the tuna markets were recognized as an issue leading to increasing pressure on stocks. Prices of tuna species sold to canneries (skipjack and yellowfin) have been stable or declining during recent years and this has driven to increased catches to maintain expensive fleets in operation. Conversely, tuna species that are used for sashimi (mainly bigeye and bluefin) are sold at increasing prices as catches decline, increasing the fishing pressure upon stocks that are often already being overexploited.

Inappropriate incentives have been widely observed for many tuna fisheries; these incentives are clearly working against a durable exploitation of tuna resources. The major issue identified was the subsidies given to tuna fisheries. These subsidies should be eliminated for all tuna stocks that are already fully exploited or overfished (and when increased effort would only leads to reduced CPUE and reduced catches).

Poverty in some coastal countries was noted as an additional factor to consider. Tuna fisheries are mainly active in the inter-tropical areas where many countries are still in a developing status. Various potential interactions were noted between tuna fisheries and local poverty. Some of these interactions are positive and they should be encouraged when others may have a negative impact on the local poverty; these negative potential impacts should be identified and minimized (at a national level). Cross-cutting these factors of unsustainability are the circumstances of artisanal and small-scale fishers especially in developing countries and small island developing States. The social and economic importance of these fisheries to foreign exchange earnings, food security, sustainable livelihoods, etc. make these fishers dependent upon continued access to adequate allocations of tuna resources.

RELEVANT IMPORTANCE OF FACTORS OF SUSTAINABILITY IN RELATION TO TUNA AND TUNA LIKE FISHERIES

1. Lack of governance

	Issues and obstacles	Also	Paths to solutions	Comments from the group
1	Lack of political will of contracting parties.		- Transparency of the decision-making process. - Proactive attitude of the RFOs[6] and their members towards environmental concerns.	Decisions taken in RFOs do not follow the commitments taken in International Instruments this is often under the influence of fishing industry lobbies.
2	Lack of participation and cooperation from non contracting parties, whether states or fishing entities.	4.3 1.7	- Non contracting parties to become members of RFOs. - Use of concept of "non contracting cooperative parties" in RFOs. - Review of allocation criteria to be consistent with UNFSA[7] - States to ensure no share to IUU fishing vessels. - Amend national legislation to give effect to relevant international instruments. - Use of concept that fishing vessels of non members = IUU fishing.	While States may be reluctant to participate because of costs involved, the group felt that lack of gain in joining an organization may cause States or fishing entities not to become a member. A number of RFOs do not provide for the participation of fishing entities.
3	Elimination of IUU fishing .	5.1	- Increase pressure on flag States. - Listing, whether white or blacklisting, of fishing vessels - Cooperation with ILO activities relating to protection of crew members. - VMS monitoring - Enhance cooperation between authorities responsible for vessel registration and those responsible for fisheries management.	See also measures provided for in the IPOA on IUU (Port State control; trade sanctions; etc.).
4	Aspirations of new members to new shares combined with reluctance of existing members to give up shares results in pressure to increase TAC.		- Distinct/separate decisions on % share allocations from decisions about overall TAC.	The problem can also increase the burden of proof for science to Demonstrate that TAC increase is not sustainable.

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[6] RFO = Regional Fisheries Organization
[7] UNFSA = 1995 UN Fish Stocks Agreement

	Issues and obstacles	Also	Paths to solutions	Comments from the group
5	Participation of developing countries (coastal states, SIDS).		- Common fund to support membership of developing countries and SIDS[8]. - Coordination mechanism among various potential members for representing interests in most cost effective way, e.g. creating sub-committee under a main body.	Reference was made to the situation in the Caribbean and the interest/wish of some States to join ICCAT.
6	Non-compliance with management decisions.		- Sanctions on trade in IUU of products. - Review concepts of flag state responsibility.	See also measures provided for in the IPOA on IUU and other relevant international instruments.
7	Conflict over resource allocation between developed and developing nations.	1.2 4.3 2.3	- Develop objective criteria to allocate resources consistent with international fisheries law. - Provide guarantees to DWFNs[9] on beneficial ownership. - Mechanisms/new allocation schemes to integrate concerns of developing countries.	Coastal countries wish to have access to resources already fully exploited by DWFNs. Reflagging of IUU fleets are feared by the DWFNs.
8	Decision-making process leads to vague & nebulous decisions because of need to find a common denominator.		- Take decisions by voting process. - Binding decision-making procedures with compulsory dispute settlement.	Consensus will only be reached on minimal measures, not on those dictated by sustainability considerations.
9	Mandates of RFOs do not address the full-range of unsustainability issues.		- Review mandate of organization. - Audit of performance/management of RFOs.	Ecosystem, economic and social considerations.

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[8] SIDS = Small Island State
[9] DWFN = Distant Water Fishing Nations

	Issues and obstacles	Also	Paths to solutions	Comments from the group
10	Lack of implementation of international instruments.		- Adoption of national legislation consistent with Int. Instruments and resolutions.	
11	Lack of support (funding) to institutions (regional and national).		- Allocation of sufficient resources to both national and international Institutions. - Training and capacity building. - Sharing of expertise between RBO and member States.	Tuna fishery is a rich fishery. Therefore, why not consider financial support for management purposes in the light of the share of the resource, the potential value of catch. This is recommended particularly where resources are overfished
12	Conflict between aims of RFOs and development agencies leading to over-investment in fishing capacity and infrastructure.	4.2	- Fisheries management objectives to take into account the issue. - Education. - Awareness of donor countries and funding agencies.	

2. Interactions

	Issues and obstacles	Also	Paths to solutions	Comments from the group
1	External factors threatening sustainability of Fisheries.		- Need to manage tuna taking into consideration the external factors. - Improved technology (e.g. to improve selectivity of fishing gear). - Cooperation between multilateral institutions, RFO, other interested parties.	External factors: e.g. by catch fisheries turtles, birds dolphins; may also include impact of international instruments e.g. CBD, CITES. Cooperation between CITES, RFO and FAO.
2	Inadequate selectivity in FAD fishery.		- RFO investigate on extent and range of interaction e.g. tagging. - Explore effects of alternative fishing method. - A moratorium, closed area/marine protected area.	- FAD fishery vs. longline fisheries : purse seiners catch juveniles while longliners catch adults. - Some fisheries management measures may have impact on economic sustainability (e.g. in case of closing FAD fishery, fishers do not have any opportunity to continue fishing skipjacks).

	Issues and obstacles	Also	Paths to solutions	Comments from the group
3	Possible interaction between purse seine and small scale fisheries.		- RFO investigate on extent and range of interaction - Collaboration between research/management organizations.	By-catch of juveniles, both small-scale and large-volume. Could be best illustrated e.g. Maldives.
4	Conflict between industrial and small-scale/sports fisheries, including focus on industrial sector and lack of information on small-scale sector.	1.7 4.1	- Setting objectives in management plan whether at national or regional level. - Division of resources (rights) - Exclusion zones - Better statistics - Case studies on economic/social impacts	Basically a national issue - problem of ethics and different perceptions as to whether there is a need to "protect" the commercial fisheries or the recreational fisheries problem of distribution of benefits; this would apply also to the pelagic shark fishery
5	Excessive catch of undersized fish.	2.2	- Improved technology to identify various species (size, type,..) e.g. electronic devices. - Investigate on more selective fishing gears.	

3. Complexity

	Issues and obstacles	Also	Paths to solutions	Comments
1	Stock assessment depends primarily on fishery dependent data.		- Fishery independent assessments such as tagging.	Stock assessment to take into account the stock in its full range.
2	Difficulty in measuring fishing power (capacity).		- Better data on technology/crew composition. - Development of different/indirect methods (modelling).	Rapid changes in technologies (gear, satellite technology, etc.), in particular with respect to purse seiners, increasing efficiency.
3	Extreme fleet mobility.	1	- Effective coordination between relevant RFOs - Harmonization of fisheries management measures adopted by RFOs. - Implementation of FAO Compliance Agreement.	e.g. exchange of information on data on fishing vessels, on management measures.
4	Uncertainty with respect to stock units.		- Investigating stock structure and consequences of this complexity.	e.g. using tagging, genetics etc.

	Issues and obstacles	Also	Paths to solutions	Comments
5	Uncertainties regarding the potential effects of tuna fisheries on the pelagic ecosystems and their dynamics.	1.9	- Take ecosystem relationships into account in management. - Mandate of RFO to include possibility to deal with ecosystem related matters.	
6	Local variability in availability of stock.	1	Regional cooperation and malleability of fleet.	There is not always a relationship between the overall stock/biomass situation and the local/biomass in a given area. This results in an internal variability in local catch within EEZ.

4. High demand

	Issues and obstacles	Also	Paths to solutions	Comments
1	Price increases because of limited resources, especially for Bigeye and Bluefin.	1.3	Ensure traceability of the products. Apply trade restrictive measures on IUU catch.	Concerns for sashimi tunas.

5. Inappropriate incentives

	Issues and obstacles	Also	Paths to solutions	Comments
1	Subsidies, especially in fully exploited or overexploited fisheries.		Eliminate such subsidies.	
2	Loan-decisions based on historical performance not future stock projections.	1.12	Better information to financial institutions.	Concerns bank loans & any other financial facility. Support to fishing vessels through support to shipyard industry occurs often.
3	Absence of secure rights to fish.	1	Establish rights & rules for allocation of quotas/rights.	

6. Poverty

	Issues and obstacles	Also	Paths to solutions	Comments
1	Impact of by-catch landing on small scale fishing.		Take into account socio economic conditions of people, including small scale fishers.	Landing of by-catch may have positive impacts (additional food) but also negative impacts (unfair competition with local artisanal fisheries).
2	Impacts of needs of small scale fishers not taken into account.	4.3	Need to take into account small communities, SIDS in the allocation of resources.	
3	Impact of by-catch landing on consumers.		Take into account socio economic conditions of people, including consumers.	

LARGE VOLUME DEMERSALS WORKING GROUP

REPORT

Large volume demersal fisheries are generally characterised by industrialised fishing fleets targeting a relatively small number of species in a large but delimited area, for commercial marketing. Compared to other types of fisheries, infrastructure for monitoring, management, and provision of science support is likely to be better developed. However, there is still substantial diversity within this class of fisheries, and individual fisheries many not have all of these characteristics. This diversity means that neither problems nor paths to solutions would be considered to apply universally across them all.

A brief discussion of Instruments concluded the following.

- They are numerous and diverse;
- diversity can be distracting from key issues, and overwhelming as a collection;
- just dealing with the main FISHERIES instruments can be challenging enough, but in planning for the future, there is a need to be prepared for addressing other type of instruments affecting fisheries (e.g. CITES);
- it was also noted that their diversity means that there has to be some selectivity in choosing which instruments and provisions of instruments should be the focus of fisheries management efforts. This introduces the threat that those doing the selecting can do so to avoid confronting problems that they don’t want to deal with, but which are clearly intended to be part of the actions motivated by the Instrument. In that sense there is a need to select and address all relevant instruments/provisions.

1. OBSTACLES AND ATTEMPTS TO ADDRESS THEM

Inventory of types of challenges was undertaken in a brain-storming format, as a *de facto* test of completeness of the framework from the Bangkok meeting. After thorough discussion it seemed that essentially every major challenge in large-volume demersal fisheries were covered in the six factors of unsustainability from Bangkok, with **INAPPROPRIATE INCENTIVES and LACK OF GOOD GOVERNANCE being by far the predominant issues**.

It was also noted that large-scale demersal fisheries were apparently the simplest case. Compared to the other types of fisheries, these will tend to be more profit/business oriented and strongly influenced by economic objectives to a greater extent than social and ecological ones. They tend to concentrate excess fishing capacity and are not easy to manage, but other types of fisheries were expected to have even more problems, and more difficult paths to solutions.

Major, more specific impediments to progress include the following.

- Lack of resources for many or all aspects of fisheries science and management is at the root of many problems in the developing countries;
- A poor fit between scale of resource and scale of governance is one possible impediment;
- Lack of knowledge of the human and economic side (including enterprise behaviour) of management, providing little basis for informed decision-making about management measures;

- situation of poor knowledge of social and economic aspects of the fisheries is made worse by willingness to substitute preconceptions and stereotypes for sound information on social/economic aspects of fisheries, while comparatively great amounts of money are spent on expanding bio-ecological scope of research;

- an incompatibility of trade legislation and fisheries objectives is a problem in some cases, and one where the tools and instruments should be available to do something about it;

- when management occurs at several levels, with perhaps local communities, national states and multi-national agencies each having different types of jurisdiction and different types of relationships with fisheries and fishers, further incompatibilities can occur. Objectives and policies may not be harmonized to begin with, and fishers and managers both may be receiving inconsistent direction on what is expected of them.

A long discussion ensued about these issues, resulting in an agreement that there is a very **strong three-way linkage from the problems of inappropriate incentives and lack of good governance to the absence of secure rights. Allocation of some degree of rights (without being specific about their nature at this point) very often would be a necessary step to address problems with incentives.** However, that step can only be taken when one is fully aware of the governance system and the nature of the fishery and its participants. Otherwise the initial problem may be only partly solved, while new and different problems would eventually be created.

In discussing if it was possible to even know how to match the type of rights to type of governance and fisheries systems, the group considered whether this was a change from science-based management to consensus-based management. In that discussion it became clear than “consensus” can have various meaning according to circumstances or context. Even in cases when it is not difficult to get consensus (agreement of all participants) on what should be done collectively in the fishery, it can still be very difficult to get agreement at the scale of what individuals should do. To most individuals and enterprises, choices are likely to be still a business issue with short term objectives.

When time comes for internalizing management costs or sharing them, groups which may have agreed with the objective, may not agree with taking on their assigned share of the cost of achieving the objectives. Consensus then may breaks down.

This impediment to progress can also be addressed (not eliminated) through more attention to social and economic sciences, rather than more biological sciences. Without such research there will be a growing diversion between the science (biological) being done, and what is actually happening in the fishery.

Another measure that would help to match the type of rights allocated to specific fisheries and to address specific inappropriate incentives is institutionalize fora where the resource scientists have to interact with social scientists, economists, and managers, and answer their questions. This is an interactive alternative to the predominant model where the biologists simply give their assessment results and leave the discussion of what should happen in the fishery to the other relevant experts and interests. Given the heterogeneity of “stakeholders” it may be an efficient strategy to use stratified discussion – consultation approach however, to address different needs of different groups.

Even where science is responsive to economics and managers, the time lag for getting responses is often too great to meet management’s needs. The Precautionary Approach should be an asset here, but in reality it is often perceived as unjustified stalling.

There was agreement that successful large demersal fisheries require a simultaneous application of a conservation perspective and the social and economic perspective of those directly associated with the fisheries, but again there did not seem to be any universal way to combine those two perspectives. In badly depleted fisheries, the former should be made predominant (conservation objectives would dominate over all others) while the latter would gain more prominence when the stocks are sound and supporting economically viable fisheries. In particular the state's responsibility for costs will generally be considered to be much higher while restoring a damaged stock than once it is recovered. Moreover, among demersal large-volume fisheries, the balance between sound business objectives (targeting economic efficiency) and social objectives (targeting community viability). Again, there seemed to be little opportunity for significant progress towards greater sustainability without social and economic science research to provide the information and understanding needed to blend the two perspectives.

The application of Rights was considered further, as a step very likely to be needed in most large scale demersal fisheries, in order to address the dangers of poor incentives. It was noted that there is a gap here, because none of the instruments seem to highlight that allocation of rights is very often a necessary first step in moving towards sustainability, even though many at least mention them. **There was also agreement that there are many types of rights, and no universal algorithm for determining which type of rights is best for which fishery. Rather, this is to be linked to the need for more study of the fishery and fishers, rather than just the fish, in order to understand what form of rights is appropriate in any particular case**.

Allocation of rights does necessarily give special privileges to some parts of society, and those receiving the benefits should contribute back to society in return for those privileges. How this is best done again can only be viewed case specifically, but if done wrong, is another case where a measure to address one problem (inappropriate incentives affecting bio-ecological and economic sustainability) results in greater social inequity – sometimes very great (affecting social sustainability). A very clear understanding of the real costs and benefits of the fisheries is needed to do the rent recovery fairly and effectively, again calling for greater economic knowledge of the fishery. Again, also, there are particular problems in the less-developed countries, where payment for access rights creates even greater potential for inequities to be present from the very onset of the rights-based system.

The other issue that was thought to be tied up with fair application of rights to address inappropriate incentives was the absence of clear management objectives for fisheries. Objectives are called for in many instruments, particularly in the Code of Conduct, but they often either have not been set, not ranked, or are so general that they allow mutually incompatible activities to be pursued. It is possible to at least begin to strengthen access rights within fisheries without clear objectives, but progress cannot go very far until objectives have been set. The objectives have to be clear enough that all sectors participating in a fishery agree that they are trying to achieve the same things, they all understand their roles and responsibilities, and things the objectives are trying to achieve are mutually compatible. The type of access rights and methods of redistribution of excess wealth from the rights can only be finalized once such objectives are available.

2. LESSONS LEARNED

There was substantial discussion about the proper phrasing of a general pattern that pervaded all the examples discussed to this point. It was readily agreed that all examples where consistent with the conclusions that:

- **The resource users are very good sources of ideas of how to solve their own problems, and many management structures do not make enough use of bottom up strategic planning**. This lesson can be applied in many types of fisheries and with many levels of capacity.

There was more diversity of viewpoints about the degree to which top-down intervention is necessary and effective. However, there were no counter-examples offered to the generalization that:

- **Top-down intervention has a crucial role when there are competing sectors who do not agree on their relative priority. Some authority has to bring competing parties who are trying to achieve incompatible goals to a common forum and gain agreement on a single set of objectives – roles and rights of each group**.

There was also wide agreement that the examples and collective experience supports the generalization that:

- **If you have serious conflicts among sectors, it is premature to attempt to implement co-management and priority must be given to resolving the conflicts among sectors**. Only after that is done is it really helpful to go to the sectors themselves for their ideas of the management approaches and rights allocation that would work best in their particular case.

2.1 Highest priority: address inappropriate incentives with rights, but minimize risk of rights causing new problems

The group acknowledges that there were many types of rights to be used according to macro-economic context and other criteria, the choice being a political issue. With regard to implementing rights at this stage in overhauling fisheries to improve their sustainability, the groups did not see any cases where assigning secure rights necessarily made things worse in the bio-ecological dimension. There are known secondary problems, such as highgrading, that can occur, but these can be addressed with monitoring and responsible stewardship. In the economic dimension the effects of rights also were generally positive, but the reversibility cost of rights can be very large. Once users have rights it costs a great deal to get the rights back if priorities change. This is another case where knowing that risk will usually be present allows planned for it. **There is a need to structure into user rights programs from the beginning some mechanism to extract a share of the value (economic rent) for civil society and to allow options for change or adaptation to exist in the future**. A number of possibilities for extracting rent were discussed. Yet again no single approach was considered universally appropriate, with the nature of the best strategy depending both on the nature of the fishery and the nature of the social unsustainabilities that were considered to be at risk of being introduced or increased through allocation of rights. The latter consideration again highlights the need for social sciences in support of fisheries management, to understand the possible social consequences of different systems of access rights.

The group considered the question that "If access rights are so good, why access rights aren't used more?" Among the contributing factors are the following:

- There are no instruments that say clearly one should deal with the rights as an early step in making large-volume demersal fisheries sustainable;

- sometimes the institutional framework has to be constructed to manage the rights allocation. In many parts of the world it cannot be assumed to exist;

- there is often no consensus on who should share the results – both among different fishing sectors, and between the fishery and society. This is especially true with fisheries which are looked at to not just cover their own operating costs, but also to generate wealth for the nation;

- sometimes the institution is too closed to be an asset in solving problems with improper incentives from the inside.

The sequence of activities and linkages would then consist of the following:

- First resolve the conflicts on what participants (and society) are trying to achieve in the fisheries, who will participate, and how wealth will be distributed;
- then initiate the process of allocating the designated participants some kinds of secure access rights, and get to know the group and work closely with them on what form of rights will work best for them;
- build or adapt the institutions needed to implement the form of rights that will work best for the particular case;
- build into the system from the beginning the ability to recover revenue as the rights become more valuable.

Implicit in applying these steps is a need to do a lot of research on the pieces – the dynamics of people, groups, and institutions at the level of the fishery, and overall research on the organizations, the fisheries, what their values are, and what the may become over time. This may include a lot of social and ethnical research as well.

2.2 Addressing problems with less-than-good governance

The core to making "good governance" more of a reality is to ensure openness, transparency, and inclusiveness. However, to make this platitude effective requires a number of choices. How can it be ensured, for example, that the stakeholder makeup of "transparency" is actually fair and representative of all the sectors of society that should participate. No standards for what comprises "inclusive" are included in the instruments and the nature of "inclusive" almost certainly varies with cultures and is constrained by the wording of national and international instruments. Moreover, transaction costs are very high when the move towards a fully participatory decision-making is made. Many countries are simply unable to support these costs.

Despite these complexities, progress on Good Governance is usually essential, and it was argued that some institutions function so poorly that the only effective option is to abandon the entire approach and start over. Knowing the degree of institutional change that is needed will require regular auditing of the performance of the management institutions. Many countries may audit performance of their national agencies, but there are no disciplinary standards for how this should be done. There are also no designated agencies nor standards for conducting performance audits of multi-national management agencies. The Marine Stewardship Council provides this function for fisheries, and in the process evaluates some aspects of the performance of management institutions. However, their reports have no status with the agencies, only the fishery which requests (and can afford) certification review.

Some comparable mechanism for auditing the effectiveness of fisheries institutions should be established, but the means for doing so, and accommodating it within the legal and policy instruments was not discussed.

3. OTHER PATHWAYS

Integrated policy and planning – Its link to the larger picture is to planning for what is going to happen to the people who did not receive rights when they were allocated to address inappropriate incentives. This also becomes a link to benefit distribution. Both are part of planning ahead to minimize the new problems created with addressing the first-order problems of inappropriate incentives.

The Precautionary Approach is a very important element of management, but its role is well explained elsewhere. The reversal of burden of proof issue is particularly important in the case of developing countries, where there will be even more cases of insufficient knowledge. This is an important input into how governance is working.

Capacity building– in co-management and improved governance settings: there is a need for training of managers for new a suite of facilitation and co-ordination skills, and of community people and all other relevant players to take on management responsibility. The democratization of decision-making needs provision of more skills and more people with those skills. This is a huge deficit in essentially all areas, particularly in developing countries. Institutions will have to provide a lot of training and the institutional mechanisms to even do the training doesn't exist in most places.

Also there is a need everywhere, but especially in the developing world, for more experts trained in analytical methods for assessing stock status, fisheries economics, and other specialities.

Market incentives – these are the types of fisheries where this tool would be most appropriate, and they play a supporting role to the measures discussed above.

COASTAL FISHERIES WORKING GROUP

REPORT

The following summarizes the discussion related to coastal fisheries. Issues and obstacles related to unsustainability were listed and discussed. Working group participants deliberated on several measures to address these issues and suggested potential paths to solutions. The results of the discussion are provided in Table 1.

Participants acknowledged the complexity of coastal fisheries and stated that many of the issues discussed were specific to certain fisheries. Coastal fisheries often have actual or potential connections with coastal communities. In such cases, the fishing community has a natural, often not recognized, role in fisheries management; thus, a need for clear definition of these communities. For the following recommendations on paths to solutions, four major types of coastal fisheries were considered, i.e. subsistence, small-scale commercial, large-scale commercial and recreational. It should be noted that in some context, an activity that will solve a problem in one fishery will make a similar problem worse in another fishery (e.g. elimination of the middlemen, see table). Also, what was identified as an obstacle in some context may become an asset in another.

Lack of good governance was considered a very important factor of unsustainability in coastal fishery management. Depending on the fisheries, measures to address this issue could include establishing community-based management, encouraging participation from all stakeholders, providing adequate and appropriate access rights to legitimate fishers (where both legal and social values may influence who is considered legitimate), strengthening and coordinating various levels of organizations and institutions, and promoting education and awareness on basic fisheries management, leadership, compliance, and law enforcement. Note that many of these measures will also address issues related to inappropriate incentives discussed below.

The importance of education as a means to address problems related to good governance was highly emphasized, and considered as an effective means to promote sustainability in coastal fisheries. Education, training and awareness rising should involve all stakeholders, including policy makers and fisheries managers. The sharing and exchange of knowledge and experiences between various stakeholders, particularly with regards to traditional and local knowledge is also critical.

Also related to the lack of good governance were issues related to poorly structured post-harvest system. We identified several paths to solutions, such as supporting fishers to market their own products (to reduce the high dependency on middlemen, in cases where middlemen are considered as a negative asset), supporting planning of market structure, and strengthening local organizations through marketing and user-right systems.

To deal with inappropriate incentives, we listed determination and allocation of access rights, improvement of MCS and enforcement, empowerment of local communities, encouraging self-policing, elimination of subsidies and dealing with wasteful fishing practices through gear innovation for by-catch reduction and reduction of habitat damage, and development and application of code of ethics/conduct.

Issues related to complexity in coastal fisheries and interactions between various sectors were considered together, as they were closely related to each other. Interactions include, for example, tourism, agriculture, aquaculture, and industrial development in the coastal areas. To address these issues, integrated policy, planning and management is required. There are three aspects to this: integrating biology, social, and economic aspects in fishery management; addressing the role of fisheries relative to other economic and social opportunities; and addressing the impacts of other activities in coastal areas and watershed on the coastal ecosystems and fisheries. Successful management for coastal fisheries depends on how components of sustainability are combined and balanced. Balancing of these components depends on, among others, the level of governance, knowledge, experience, incentives, and rights. In this context, fishery management should be fine-tuned, adaptive, and iterative.

Resource vulnerability, related to bio-ecological aspects, pollution, habitat destruction and interactions with other coastal activities, was identified as another important obstacle to coastal fisheries management. It was noted that the complexity in coastal fisheries and the sequential effects of fishing and the linkages to other systems cause difficulties in management. Assessment tools applicable to coastal fisheries are not always available. There is a need for research, experimental management, and integration of sciences (natural and social) and traditional knowledge. Fishers and other users should be involved in data collection, analysis and interpretation, as well as monitoring and reporting activities. Paths to solutions also include establishment of marine protected areas, applying integrated coastal zone and watershed management and planning, and strengthening legislation dealing with land-based pollution.

Table 1. below, shows the results of the working group discussion related to obstacles, issues and potential paths to solutions related to four types of coastal fisheries, i.e. subsistence, small-scale commercial, large-scale commercial and recreational. Note that the suggested solutions are neither exhaustive nor universal; and they can be applied in many combinations, depending on the specific context.

COASTAL FISHERIES WORKING GROUP

Factors of unsustainability	Issues and obstacles	Possible paths to solution
Lack of good governance	1. Conflicts	1.1 Provide forum / mechanisms for conflict resolution
	1.1 Gears, segments	1.1.1 Within fishers - provide rights / legislation /internal rules
	1.2 Disruption due to outsiders' entry / new entrants	1.2.1 Provide rights / legislation
	2. Lack of mechanisms for cooperation and co-ordination (institutions, user groups, scientific disciplines, organised groups)	2.1 Between fishers and management - open, transparent co-management system
		2.2 Make use of local institutions (e.g. cultural institution, church, local sport club)
		2.3 Need to involve social scientists
		2.4 Establish committees involving all user groups
	3. Level of organization	3.1 Need to strengthen local organizations (e.g. through marketing and user rights, etc.)
		3.2 Increase efficiency, or provide rewards when reaching targets (e.g. increase budgets to FMO when succeed) - to support good effort for management (performance indicators)
	3.1 Poorly structured post-harvest system	3.1.1 Provide incentives / reward to communities to settle internal problems
		3.1.2 Support planning of market structure

Factors of unsustainability	**Issues and obtacles**	**Possible paths solution**
		3.1.3 Support fishers to market their own products
	3.2 Political pressures / lobbies / political clout of recreational fishermen	3.2.1 Encourage (establish) open, transparent, accountable processes / institutions
	3.3 Poor organization of fishers	3.3.1 Education and training (leadership, basic management, biology, vocational)
		3.3.2 Encourage establishing of groups, cooperatives, associations, unions, fishing clubs, etc.
		3.3.3 Strengthen / making use of existing organizations (can be NGOs, church, and other community organizations)
	4. Difficulty in MCS & Enforcement	4.1 Post harvest control (e.g. at the landing sites or at the buyers)
	Notes: Depends on a whole spectrum and dichotomy (resources are good or bad, migratory or not)	4.2 Establish community-based management (to encourage self-policing)
	Notes: Local MCS can take place even with migratory fish (e.g. salmon, because community concerns with habitat). Manage from shore (from inside, managing the fishers, not the fish)	4.3 Education and awareness to encourage compliance
		4.4 Use high penalty / punishment to deter violations
		4.5 Educate the law enforcement and court
		4.6 High probability of being caught (through increase monitoring and surveillance)
		4.7 Encourage international cooperation in MCS & E (e.g. to combat illegal exportation)
	4.1 Lack of resources for MCS & E	4.1.1 Provide adequate and sustained resources
	5. Roles of communities in management	

Factors of unsustainability	Issues and obstacles	Possible paths to solution
	5.1 Lack of recognition by fisheries management agencies	5.1.1 Involve other government agencies in fisheries management (along the line of integrated management)
		5.1.2 Education and awareness creation of fisheries management agencies
		5.1.3 Facilitate exchange of knowledge and experiences between fisheries managers at the working level, and between managers and communities and other resource users. Share success stories and facilitate implementation of pilot community management projects.
	5.2 Lack of incorporation of community knowledge to contribute to management	5.2.1 Acknowledge the importance of relevant traditional knowledge of resources, sciences and management, balancing with modern sciences and management
	5.3 Inability to use the knowledge for management	5.3.1 Creating inventory of knowledge
		5.3.2 Try to scale up the knowledge
		5.3.3 Conduct social science research
		5.3.4 Channel / communicate the knowledge to management (know your customers for better packaging)
	6. Policy / regulations	
	6.1 Lack of clear policies for coastal fisheries management	6.1.1 Set clear, practical, achievable objectives and policies through consultation with all stakeholders
	6.2 Lack of secure rights	6.2.1 Knowing all varieties of rights, and understanding attributes, and establish system of allocating rights, and obligations
		6.2.2 Association between rights and specific contexts
		6.2.3 Back up the rights, by law and subsidiarity (devolve and participate to the appropriate level)

Factors of unsustainability	**Issues and obstacles**	**Possible paths to solution**
	6.3 Inapplicable / inadequate regulations	6.3.1 Constantly evaluating performance of fishery management and regulations
		6.3.2 Create competent institutions for evaluation of management
		6.3.3 Provide information on needed regulations
		6.3.4 Formulation of fishery management plan
		6.3.5 Need for compatibility of regulations at various levels (local community to the whole fishery)
		6.3.6 Need coordination between administrations (e.g. safety at sea, conservation)
	7. Unmonitored and unmanaged technology leading to unsustainability	7.1 Better monitoring of the technology, and adjustment of management according to (or to account for) the improved technology (e.g. reduce the catch, ban the gear)
Poverty and lack of alternatives	1. Lack of alternative employment	1.1 Need integrative planning for diversity of economic opportunity for the community (multi-specificity)
		1.2 Need training and education of new skills
		1.3 Need to involve multiple branch of government (macro level)
	2. Unmanaged shifting from other activities to fishing	2.1 Allocating and managing rights (give priority to legitimate fishers)
	Notes: can be good or bad depend on how we handle it. Can help restore the stock or deplete the stock.	
	3. Resistance to Change	3.1 Provide appropriate incentives
	4. Coastal population growth / coastal migration	4.1 Need integrate planning
		4.2 Education in family planning

Factors of unsustainability	Issues and obstacles	Possible paths to solution
		4.3 Provide infrastructure, opportunities and alternatives inland to distribute concentration of people
		4.4 Access rights to legitimate fishers
	5. Lack of saving culture	5.1 Vocational training (simple book keeping and accounting)
		5.2 Use simple loan and credits and saving schemes
	6. High dependency on the middlemen	6.1 Create awareness to rid of bondage
		6.2 Build marketing infrastructure
		6.3 Establish and strengthen marketing cooperatives
		6.4 Provide credit schemes
Inappropriate incentives	1. Low entry cost / open access	1.1 Access rights
		1.2 Improve enforcement and MCS
		1.3 Economic diversification
	2. Use of illegal fishing practices	2.1 Sanction, MCS
		2.2 Secure access rights
		2.3 Education
		2.4 Empower local communities (getting their attention to the problem)
		2.5 Code of ethics / conduct
	3. Too much subsidies for investment in new technology	3.1 Eliminate subsidies
	4. Wasteful fishing practices	4.1 Create market
		4.2 Gear innovation for reducing by-catch
		4.3 Education and regulation
		4.4 Find ways to use by-catch
		4.5 Code of ethics / conduct

Factors of unsustainability	Issues and obstacles	Possible paths to solution
Complexity and lack of knowledge / Interactions with other sectors	1. Inappropriate application of many methodological, standard resource assessment tools to coastal fisheries	1.1 Bring in innovative research on management strategies
		1.2 Use iterative process, adaptive management, and treat it as an art. Fine-tuning and dynamic process
		1.3 Utilize performance indicators
		1.4 Involve fishers and traditional knowledge in data collection and analysis and interpretation
		1.5 Establish and improve monitoring and reporting
	2. Resource vulnerability	
	2.1 Bio-ecological vulnerability	2.1.1 Build robustness in the management strategy, use precautionary approach
		2.1.2 Establish marine protected areas
	2.2 Pollution	2.2.2 Integrated coastal zone and watershed management and planning
		2.2.3 Need legislation to deal with land-based pollution
	2.3 Habitat destruction	2.3.1 Education
		2.3.2 MCS
		2.3.3 Banning
		2.3.4 Integrated coastal zone and watershed management and planning
		2.3.5 MPAs
	2.4 Interactions with other coastal activities	2.4.1 Integrated coastal zone and watershed management and planning
		2.4.2 Zoning
	3. Lack of knowledge	3.1 Need biological, social, and economic inputs

PART II: DISCUSSION PAPERS

I. LARGE VOLUME SMALL PELAGICS

2. THE LARGE VOLUME SMALL PELAGIC FISHERIES OF THE SOUTHEAST ATLANTIC: ANGOLA, NAMIBIA AND SOUTH AFRICA
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2. THE MANAGEMENT OF THE SMALL PELAGIC FISHERY IN CHILE
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II. TUNA AND TUNA-LIKE SPECIES

3. BIOLOGICAL OVERVIEW OF TUNAS STOCKS OVERFISHING
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III. LARGE VOLUME DEMERSALS

5. THE BRITISH COLUMBIA ROCKFISH TRAWL FISHERY
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IV. COASTAL FISHERIES

8. THE MANAGEMENT OF MEDITERRANEAN FISHERIES RESOURCES - COASTAL FISHERIES IN ITALY
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9. THE MANAGEMENT OF MEDITERRANEAN FISHERIES RESOURCES - COASTAL FISHERIES IN THE MEDITERRANEAN REGION
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10. WEST AFRICAN COASTAL AND SMALL-SCALE DEMERSAL FISHERIES
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by Philippe Cacaud

DISCUSSION PAPER 1

THE LARGE-VOLUME SMALL PELAGIC FISHERIES OF THE SOUTHEAST ATLANTIC

ANGOLA, NAMIBIA AND SOUTH AFRICA

by

David Boyer and Helen Boyer[10]

Summary

The factors leading to unsustainability are discussed in relation to the large-volume small pelagic fisheries of the south-east Atlantic. Namibia has a fisheries management system that incorporates many of the accepted best-practices as outlined in the major international fisheries conventions. The South African management system is very similar, while, owing to several decades of civil war, the Angolan system is still in the early stages of development. Despite the similarity in the management systems of South Africa and Namibia, Namibia's sardine and anchovy stocks are in a severely depleted state, while, in contrast, South Africa's stocks are fully recovered. Furthermore, in addition to having an acclaimed management system with generally effective control and enforcement, the Namibian bio-ecological system is also seemingly conducive to successful fisheries management. The system contains relatively few species and is clearly defined, with few shared or straddling stocks. The state of the Namibian small pelagic stocks clearly indicates that current fisheries management systems are not effective at managing highly variable and dynamic fish stocks and it is therefore, concluded that external effects also play a significant role. Until these are understood, and incorporated into management policies, unsustainable fisheries are likely to recur.

1. BACKGROUND

This review focuses on the large-volume small pelagic resources of the southeast Atlantic, a region that has seen massive political and social reforms during the past decade. It, therefore, begins with a brief review of the socio-economic climate within which the current fisheries management systems have developed (Section 1.1). This is followed by a short description of the major fish stocks and fisheries and the international agreements that the three countries of the region are party to (Sections 1.2 and 1.3). The main body of the review describes how the management strategies of these countries relate to the various international fisheries management instruments (Section 2). Finally the two questions posed in the analytical framework are addressed, namely whether fisheries management has been successful and what in terms of international instruments needs to be done to reduce unsustainability (Sections 3 and 4).

While the review covers the three countries of the southeast Atlantic, Angola, Namibia and South Africa (Fig. 1), information relating to Angola is difficult to obtain and therefore, many of the examples are taken from Namibian and South African fisheries. When a single example has sufficed, this has generally been taken from Namibia, as the current fisheries regime is more mature in that country and the authors are more familiar with this system.

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[10] The views expressed in this paper are solely those of the authors, David Boyer, Chief Fisheries Biologist (Pelagic Resources) and Helen Boyer, Fisheries Biologist (Small Pelagic Resources), Ministry of Fisheries and Marine Resources, National Marine Information and Research Centre, Swakopmund, Namibia, boyer@iafrica.com.na.

1.1 Socio-economic climate

1.1.1 Angola

Angola is emerging from more than two decades of civil war following Independence in 1975 and is considered a "least-developed" country. National priorities have therefore, been focused on other issues and until recently fisheries have received limited official support. The fisheries sector is an important component of the economy, being third after oil and diamond mining; although in terms of exports this amounts to less than 1 percent of total exports compared to 70 percent for oil.

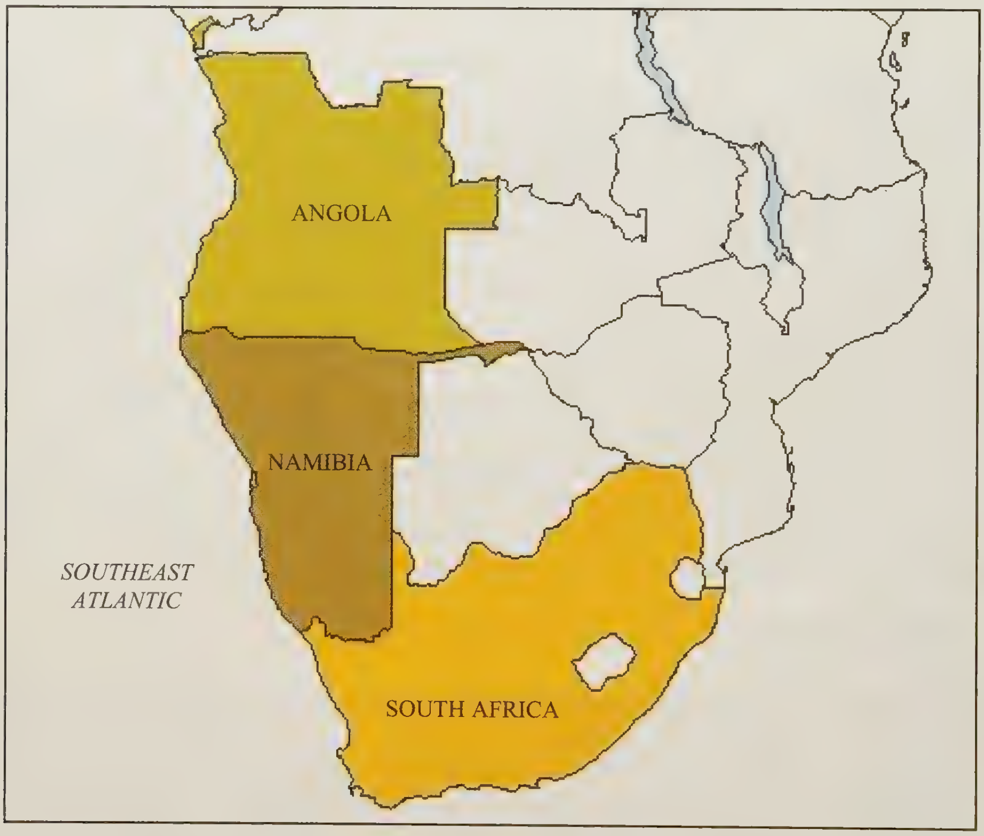

Figure 1. The countries bordering the southeast Atlantic

Fishing provides half of the animal protein of the country, and annual per capita fish consumption is the highest in the SADC[11] region; 40 kg in coastal regions, 10 kg inland and 16 kg overall (BCLME 2002). It is an important source of employment for coastal communities, especially the poorer sector of society, and although the artisanal sector only accounts for around 18 percent of the landings, over 60 percent of the estimated 35 000 fishers are employed in that sector (SADC 2002).

The current potential of Angola's fisheries has been estimated at around 360 000 tonnes per year, of which 285 000 tonnes are small pelagics (SADC 2002). In 1999 around 200 000 tonnes were landed, with the purse seine catch dominant at 80 000 tonnes (SADC 2002). Most was caught by the national fleet with only 32 000 tonnes caught by foreign vessels. Although only five percent of the catch is exported, about half of the revenue comes from exports, with prawns accounting for roughly half of this (BCLME 2002). The contribution of fisheries to GDP was estimated to be between three percent and five percent in the latter part of the 1990s (SADC 2002).

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[11] SADC is the Southern African Development Community and consists of the following countries; Angola, Botswana, Lesotho, Malawi, Mauritius, Namibia, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.

The authorities generally lack the capacity, both in terms of manpower and finances to effectively manage the fisheries resources. Until recently fisheries issues have been low on the political agenda, largely because of the pressing priorities elsewhere, but possibly also due to the relatively low importance of fisheries compared to the considerably more valuable mining industry. There are some indications that as the country normalises that political will is starting to address urgent fisheries management issues.

1.1.2 Namibia

Namibia gained Independence in 1990 and the newly elected government inherited severely over-fished stocks of all commercial species. The authorities, realising the potential value of fisheries to the fledgling post-Independence economy, implemented aggressive policies to re-build the fish stocks. Research was initiated with support from foreign donors, an effective monitoring, control and surveillance regime was implemented and a legal framework to facilitate these initiatives was enacted. Indeed the Namibian constitution is the first in the world to include sustainable utilisation of natural resources (Brown 1996), and this led to the necessity for the enactment or reform of a number of Acts that seek to conserve Namibia's natural resources, while promoting their utilisation.

Social imbalances created by years of apartheid policies were addressed through "Namibianisation" of the fishing sector. This was largely implemented through manipulation of the fishing levies in favour of Namibians. Similarly, a job creation policy over the last 12 years has seen employment in the sector grow from around 5 000 Namibians to 14 000.

In 1990 Namibia was therefore, in an enviable situation in terms of fisheries management: the authorities were able to initiate a new management regime without the historical social and political constraints that so often inhibit policy changes.

Namibia is classified as a "developing" country, although the fisheries sector more closely resembles that of a modern developed nation. Catches have remained fairly constant between 500 000 and 600 000 tonnes per annum since Independence and the contribution of fisheries to the GDP has ranged between six and eight percent. Exports have however increased from about N$ 830 million[12] in 1992 to N$2 600 million in 2000 making fisheries the second most important sector of the Namibian economy, after mining.

1.1.3 South Africa

South Africa held its first democratic elections in 1994, marking a break from the previous white-dominated apartheid system. In general the new South African administration inherited robust fish stocks, with the pelagic stocks in particular recovering following an extended period of depletion.

As with Namibia, the previous administration had created considerable social imbalances. These are being addressed by adjusting the ownership/quota allocation in favour of local communities who previously had little chance of competing against the large multi-national fishing companies. This period of "transformation" (as it is known) has created instability in the industry with many new entrants and the reduction of rights to established companies (FAO 2001a).

Approximately 27 000 fishers are employed in the fishing industry catching between 500 000 and 700 000 tonnes per annum (the variation is largely determined by the abundance of the small pelagic resources). Most of this is used locally, although exports have increased in recent years, mainly hakes.

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[12] US$ 1 equalled approximately N$ 9 in early 2003

Only a small proportion of the small pelagic landings are exported, mainly to the United Kingdom (200 tonnes, valued at US$ 300 000 in 2000, compared to 2 600 tonnes from Namibia, EU 2001). Per capita consumption is 6.4 kg/year. Fisheries contribute less than one percent towards GDP, although within some regions, especially the Western Cape, this figure is much higher.

1.2 Fish stocks and fisheries

The large-volume small pelagic fish stocks of the region can be grouped into three categories: the sardinellas *Sardinella aurita* and *S. maderensis*, sardine *Sardinops sagax* and anchovy *Engraulis capensis* and the horse mackerels *Trachurus capensis* and *T. trecae*. These resources all occur close to the coast, well within the EEZs of the three countries.

1.2.1 Sardinellas

The two species of sardinella are, within the region under review, restricted to Angola, although these stocks are shared with countries to the north. In the past sardinella was utilized by the Soviet fleet for fishmeal, but it is increasingly being frozen for human consumption. The catch was about 50 000 tonnes in 1996, compared to between 60 000 and 100 000 tonnes between 1955 and 1973 (Hampton *et al.* 1998) (Fig. 2a).

1.2.2 Sardine and anchovy

The sardine and anchovy stocks of the southeast Atlantic are almost entirely restricted to Namibia and South Africa. Both species occur as northern and southern stocks, which, although genetically identical, are considered separate for management purposes as they are geographically widely separated and according to tagging and genetic studies mixing takes place at a very low rate. Although most of the northern stock of sardine (referred to as the northern Benguela stock) occurs in Namibian waters, its distribution extends into Angola, where it is found in the relatively cool waters just north of the Namibia/Angola border, making this a shared stock. Whereas the anchovy and sardine stocks of South Africa, which occur in the southern Benguela and Agulhas systems, are currently at record high levels (Figs. 2e & f), the northern Benguela stocks are severely depleted (Figs. 2c & d).

1.2.3 Horse mackerels

Trachurus trecae occurs in Angola while *T. capensis* occurs in all three countries. As with sardine and anchovy, the northern and southern Benguela stocks of *T. capensis* are widely separated and although genetically identical are considered separate stocks. Southern Angolan is the northern limit of the distribution of *T. trachurus*, but the biomass occurring in Angolan waters is small and therefore for management purposes this stock can be considered as "Namibian". As with sardinella, *T. trecae* was exploited mainly for fishmeal in the past but is now increasingly frozen for human consumption, although in July 2002 the Russian fleet was granted a quota of 300 000 tonnes of small pelagic fish, which will be largely horse mackerel (Lankester 2002), and presumably this will be used for fishmeal. Also in common with sardinella, a small catch of perhaps 2 000 tonnes per annum is taken by artisanal fishers for local consumption. Figure 2b shows the total biomass and catch of this species during recent years. *T. capensis* is fished by two fleets in Namibian waters, with purse seiners harvesting the juveniles close to the coast and midwater trawlers catching the adult part of the stock further offshore in waters of 200 m and deeper. Catches of the two fleets averaged 68 000 tonnes and almost 300 000 tonnes per year respectively during the 1990s (Fig. 2g). In South Africa purse seine catches of juvenile *T. capensis* are severely restricted in an attempt to increase the midwater fishery that targets adults. The total catch of this species is considerably less than that of Namibia.

1.3 International agreements

The countries of the southeast Atlantic have signed most of the major international fisheries conventions, agreements and arrangements. In addition, several regional fisheries management and research instruments have also been signed in recent years (see also 2.4.4). Not all of these agreements have been ratified, for example South Africa has yet to ratify the UN Fish Stocks Agreement (UNFSA)[13] and the FAO Compliance Agreement[14]. Namibia is unusual in that soon after an international or regional instrument is signed the full text is published in the national Gazette, which means that the instrument becomes legally enforceable (see Sect. 37 of the Namibian Marine Resources Act, MFMR 2000). Thus, ratification occurs almost simultaneously to the country becoming a signatory.

The SADC Protocol on Fisheries has recently been adopted (signed August 2001). This Protocol incorporates international best practice for fisheries management and the key elements of various international instruments, thereby promoting sustainability of the fish stocks and ecosystems of the SADC region and the communities reliant on them. This Protocol has not yet come into force, but there are high expectations that it will have a positive effect on fisheries management in the region.

Another agreement that should improve cooperation between fishing nations of the southeast Atlantic is SEAFO[15]. This organization has been negotiated within the framework of the UNFSA to manage the high seas stocks of the southeast Atlantic. It will not have any direct bearing on the large-scale commercial small pelagic fisheries of the region, however, any mechanism that improves communication, transparency and, crucially, trust between nations sharing fish stocks is likely to have a positive impact on the management of shared resources.

Two further initiatives that have had a significant impact on the fisheries management of the region are the BENEFIT[16] and BCLME[17] Programmes. These two programmes are complimentary research activities that, apart from investigating many of the key biological complexities of the Benguela Current system, have served to bring together the scientists and managers of the region. Language barriers and cultural differences across the political spectrum have been reduced, enhancing communication between the fisheries scientists of the region, and also at the managerial and political levels.

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[13] UN Agreement for the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

[14] FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas.

[15] SEAFO is the Southeast Atlantic Fisheries Organization (see section 2.4.4 for more details).

[16] BENEFIT is the Benguela Environment Fisheries Interaction and Training Programme (section 2.4.4).

[17] BCLME is the Benguela Current Large Marine Ecosystem Programme (section 2.4.4).

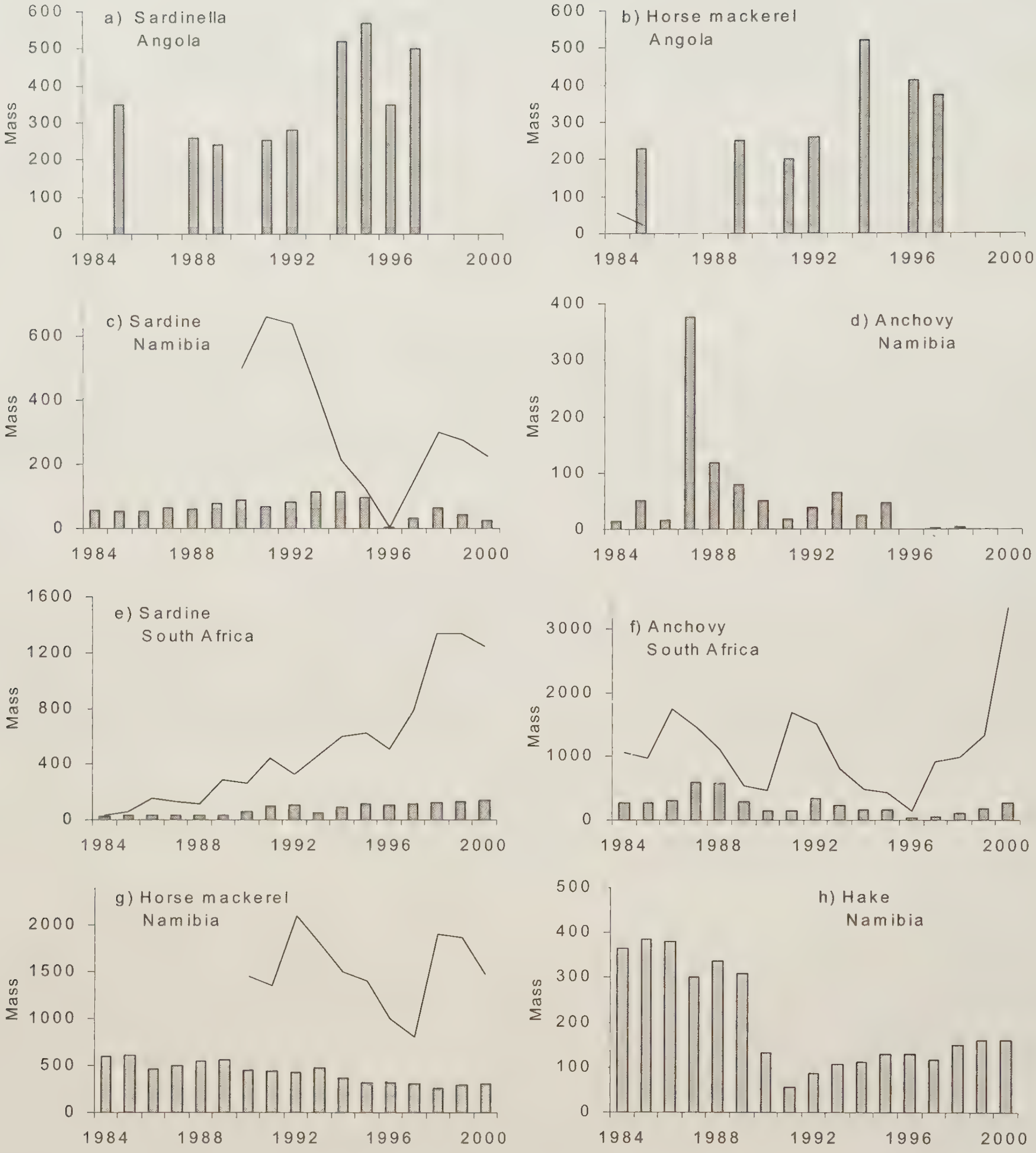

Figure 2. **Annual catch and biomass estimates (in thousands of tonnes) of the large volume small pelagic resources of the southeast Atlantic (bars = catches, lines = biomass). Namibian hake is also presented. Note that some species are not assessed, and not all data are available**

2. IS FISHERY MANAGEMENT SUCCESSFULLY ACHIEVING THE FOUR COMPONENTS OF SUSTAINABILITY?

2.1 Bio-ecological component of sustainability

A general theme that is prevalent in virtually all of the main international instruments is that of protecting, conserving and restoring fishery resources, the environment, habitat, ecosystem and biodiversity.

All three countries have demonstrated recognition of the importance of conserving fisheries resources and restoring depleted or overfished stocks to higher levels through various official proclamations, many of which have been translated into policies and legal instruments.

The Angolan Constitution, which is much older than Namibia and South Africa's, makes no direct reference to the sustainable utilisation of marine resources, but the recently formulated fisheries policy clearly promotes such practices.

The Namibian Constitution requires that natural living resources are sustainably used. The policies and legal framework for implementing fisheries management incorporate the main elements laid down in international instruments and these have gained widespread praise internationally (MFMR 2002a).

Similarly the South African Constitution also requires the protection and optimal utilisation of natural resources, and the Marine Living Resources Act (RSA 1998) provides specifically for the conservation of the marine ecosystem, the long-term sustainable utilisation of marine living resources and the protection and orderly access to exploitation of resources.

However, these countries have had mixed success at implementing these policies as illustrated in several of the examples below.

2.1.1 Prevention of overfishing

The southeast Atlantic has a history of excess capacity and overfishing. This has been considerably reduced in some sectors, while in others it is still problematic.

Angolan fisheries are managed by a mixture of licences and TACs. Unfortunately the systems used to ensure that TACs are adhered to are frequently insufficient and therefore these controls have limited effect (Hampton *et al.* 1999). Overfishing is therefore, believed to still occur in some sectors, although this seems not to be the situation in the small pelagic fishery (see 2.3.1).

In Namibia fishing is also limited primarily through output controls consisting of individual non-transferable quotas, although entry rights are also enforced. Catches must be landed at one of two fishing ports (transhipments at sea are not permitted) under the control of fisheries inspectors while an effective surveillance system of patrol vessels, aerial patrols and on-board observers ensures that all other legal requirements are met. Indeed Namibia has developed a reputation as having one of the more effective monitoring, control and surveillance (MCS) systems (Nichols submitted). Of the total landings 90 percent come from TAC controlled stocks and so the Namibian authorities have been able to control the fishing pressure on these stocks and as outlined in the next section this has yielded very positive results in some sectors. The South African system of management is very similar to the Namibian system, but lack of compliance and control, particularly in the near-shore fisheries is an on-going problem (see 2.4.3). Of note is the fact that the South African pelagic fishery is the longest standing quota-managed fishery in the world

While excess capacity (and consequently over-fishing) is a burning issue for many of the fishing sectors in South Africa, large increases in the biomass of the sardine and anchovy stocks during the past decade, and hence TACs, have resulted in a short-fall of catching capacity and the industry has been unable to utilise the full TAC (see also 2.4.4). In contrast, the small pelagic purse seine fleet in Namibia has declined from 35-45 vessels in the 1980s and early 1990s to less than 15 vessels by the millennium in response to declining TACs. Even so, these vessels are normally active for just a few months of the year, catching less than 10 tonnes per GRT each year. This compares to about 90 tonnes per GRT per year in the mid-1970s, suggesting that a large over-capacity still exists (Manning 2000). Similarly, most of the Namibian canning and fishmeal plants lie idle for the greater part of each year.

Some resources, however, are unmanaged and consequently tend to be overfished. For example, Namibian anchovy was once of major importance, but since the late 1980s there have been no output controls. Catches have declined to less than 2 000 tonnes per annum for much of the past decade (Fig. 2d) compared to over 200 000 tonnes in the 1970s (Boyer and Hampton 2001), although the relative importance of environmental impacts and fishing in this decline is not clear. It is of interest, however, that in comparison the South African anchovy stock, which is carefully managed, is currently at record levels (Fig. 2f).

2.1.2 Protect, conserve and restore fisheries resources

The authorities in all three countries have tended to follow the scientific recommendations on TACs to a degree rarely seen elsewhere. In the case of Namibia and South Africa there are demonstrable recoveries of some previously depressed fish stocks, illustrating that these countries have successfully reduced overfishing and these resources are recovering towards their previous levels.

Historically both the South African and Namibian sardine and anchovy stocks have shown typical responses to fishing. The sardine stocks in both countries were heavily fished in the 1960s and suffered spectacular crashes. Anchovy replaced sardine in the southern Benguela, while a mixture of anchovy, juvenile horse mackerel and reduced catches of sardine sustained the industry in Namibia. Under a cautious management strategy the South African sardine stock has gradually recovered to the extent that by 2002 the resource was probably as large as it has ever been since fishing started (Fig. 2e). Anchovy, being a short-lived species, has shown more variability, but has also yielded very large catches during the past decade (Fig. 2f). In contrast, as noted below, the biomass of both species has been at an all-time low in Namibia for much of the past decade (Figs. 2c & d).

While not a pelagic stock, the well-documented example of the recovery of the Namibian hake stocks *Merluccius capensis* and *M. paradoxus* during the 1990s is another example of stringent management eventually bearing fruit (Fig. 2h). At Independence in 1990, the Namibian authorities inherited an over-fished hake stock. Fishing licences for foreign vessels were denied and a TAC of just 60 000 tonnes was granted to local operators, more than a six-fold reduction compared to the annual catches of the previous decade. As the various biomass indices indicated that the stock was recovering the TAC was gradually increased and in the 2000/1 fishing year it was 195 000 tonnes

However, not all management strategies have worked. For example ten years after Namibian Independence the biomass of the northern Benguela sardine stock was as low as it had ever been since fishing began. After encouraging signs of a recovery soon after Independence, adverse environmental conditions during the middle of the 1990s, combined with overfishing resulting from an unwillingness on the part of the authorities and the industry to take heed of the warning signs of poor recruitment and a falling biomass, reversed the gains made. By the end of the 1995 fishing season the stock had fallen to a few tens of thousands of tonnes, but when these fish migrated into southern Angola, Namibian purse seiners obtained licences to harvest them and the population was virtually fished out (Boyer *et al*. 2001). Since then, due to its importance to the economy and the number of workers employed by this industry, relatively small TACs were granted in the hope that they were sufficient to maintain the industry, while at the same time small enough to allow a recovery in the stock. When in 2002 it became clear that this policy was not working and the stock had fallen to extremely low levels, all sardine-directed fishing in Namibian waters was stopped.

Except for what was probably a crucial period in the mid-1990s, adult fishing mortality rates were broadly similar for both the northern and southern Benguela stocks during the 1980s and early 1990s while the juvenile fishing mortality rate was considerably less in the north (see below), yet the biomass of the South African stock is currently at a record high level. It is quite possible that a regime shift[18] has occurred, or the stock size is so low that dispersal[19] is occurring, and therefore the Namibian stocks may never recover. It is tempting however to speculate on what the current biomass could be if the stock had received adequate protection during the period of adverse environmental conditions. This experience also underlines the importance of a management agreement between Namibia and Angola for this stock.

2.1.3 Limiting by-catch

Excessive by-catch is recognised as a contributory factor to unsustainability, and the need for its control is noted in a number of international instruments.

Namibia has developed a unique system to minimise by-catch whereby no edible or marketable fish taken as by-catch may be discarded, which is monitored by ship-board observers, and levies must be paid on the by-catch (see Table 1, 2.3.2). The levies are high enough to discourage targeting on such species, but not so high as to encourage discarding. Evidence that this system works comes from the hake fishery. Monk has traditionally been a valuable by-catch and constituted around three percent of the total hake fishery landings. When the by-catch levy was introduced by-catch of monk declined immediately to less than two percent as a result of reduced targeting of this species.

Further by-catch limitations are imposed in the midwater trawl fishery. If catches of hake or young horse mackerel exceed five percent the fleet must leave that area. Similarly, if the purse seine fleet catches more than five percent juvenile sardine, the area is closed to fishing for several weeks. However, it has to be noted that rumours of discarding of young sardine constantly circulate in the fishery, indicating that control of juvenile sardine fishing mortality may not be entirely successful.

South Africa has developed an unusual method of limiting by-catch of young fish in their purse seine fishery. This fishery is complicated by the fact that the two main target species, sardine and anchovy, cannot both be optimally utilized, as there is a significant by-catch of juvenile sardine in the anchovy directed catches. About 80 percent of the anchovy catch is juveniles, and the juveniles of these two species shoal together. Thus the higher the anchovy directed catches, the greater the by-catch of juvenile sardine, which may negatively affect the future adult sardine directed fishery. In order to control this by-catch, and to obtain the best possible anchovy catch without putting the sardine fishery at risk, anchovy TACs and sardine by-catch limits are set three times during the year, according to a pre-defined management procedure. In essence the allowable catch of anchovy is adjusted according to the species mix and the catch of juvenile sardine, which itself is dependent on the total sardine stock size and the number of recruits (De Oliveira 2001).

Angola, Namibia and South Africa also use a variety of technical measures in the trawl fisheries to allow escapement of small unwanted fish, but Namibia has also recently made compulsory the use of fixed selection grids in the hake trawl fishery. While this is primarily to allow pre-recruits of the same species to escape, it will also enable smaller unwanted by-catch species to also escape.

2.1.4 Ecosystem management

Ecosystem approaches to management are currently being investigated in South Africa and Namibia (through a BENEFIT/FAO/Government of Japan Cooperative Programme GCP/INT/643/JPN, FAO 2001b), and indeed a stated goal for Namibia's fisheries is to establish a fully functional ecosystem health monitoring system by 2005 (MFMR 2002a). Both the Marine Resources Act, 2000 (Namibia) and the Marine Living Resources Act of 1998 (South Africa) include legislation prohibiting destructive fishing practices such as the use of driftnets and fishing methods using explosives, poisons and other noxious substances.

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[18] A change in the ecosystem, possibly driven by over-fishing, where the long-term abundance of a suite of species declines. Such changes may be irreversible.

[19] At very low biomass levels spawning decreases to such an extent that the stock cannot recover.

However, issues of more general environmental health (including ecosystem and biodiversity issues) are much less well recognised than those of sustainable utilisation and receive less support from the region's fisheries authorities. Small pelagic stocks are often considered key species exerting a wasp-waist control on the ecosystem (Cury *et al.* 2000), therefore, the responsible management of this species is of critical importance to the functioning of the ecosystem.

For example, during the period that the sardine and anchovy stocks have been in a depressed state in Namibia, no allowance has been made for endemic seabirds that rely on these stocks for food when setting catch levels. This is despite a decline in the populations of these seabirds to such low levels that they are classified as threatened or endangered, largely as a result of the reduction in available prey (Crawford *et al.* 2001). However, the Namibian authorities are currently drawing up National Plans of Action for several vulnerable groups, especially seabirds and sharks, and these are expected to incorporate ecosystem considerations.

It is worth noting that at the 2001 Reykjavik Conference on Responsible Fishing in the Marine Ecosystem the Namibian Minister of Fisheries and Marine Resources (Dr A. Iyambo) was elected Chairman of the Drafting Committee fort the conference declaration (Reykjavik Declaration on Responsible Fishing in the Marine Ecosystem), indicting that such issues are understood at the highest level in Namibia. In addition, one of the main goals of BCLME is to implement ecosystem management (see Section 2.4.4) and therefore, some progress is expected in this field in the near future.

2.1.5 Multispecies management

Productive upwelling systems such as the Benguela are typified by large stocks of few species that lend themselves to single species management more readily that more complex marine systems. It is therefore not surprising that all three countries issue single species rights, although there are some examples of multispecies management measures, for example the sardine and anchovy fishery in South Africa described above. Indeed this fishery is a classical example of successful multispecies management where the development of an operational management procedure (OMP) has seen catches maximised and stabilised, while also enabling the industry to select the proportions of the two species that they harvest (De Oliviera 2001).

There are, however, multispecies fisheries that harvest several species, yet the catch of only one species is controlled. For example, rights for tunas and swordfish (*Xiphias gladius*) in Namibia have recently been extended to include all "large pelagics". While catches of these species are controlled through a TAC (the level of which is determined by ICCAT), other "large pelagics" such as sharks are now being targeted by many operators. Indeed, several thousand tonnes are now caught annually. Unless controlled this figure is expected to increase putting the sustainability of several shark species at risk. Similarly, when a right of exploitation for small pelagic fish is given in Namibia, limited quotas for sardine and juvenile horse mackerel are issued, but there are no limitations regarding other small pelagic species. This means that any right holder may catch unlimited amounts of anchovy, round herring (*Etrumeus whitheadi*), chub mackerel (*Scomber japonicus*), and, although rarely targeted, pelagic goby (*Sufflogobius bibarbatus).*

2.2 Social component of sustainability

Social aspects of fisheries management do not feature highly in the main international instruments. Several have been identified in the analytical framework and are reviewed below, but an additional aspect, equity, was felt to be of importance (see also Cunningham and Maguire 2002) and therefore this is also discussed here.

2.2.1 Optimal utilisation of resources

The catches from small pelagic fisheries are fully utilised with little waste, however, much is processed into low value products. In common with many large volume small pelagic fisheries around the world much of the produce from Namibia and South Africa is in the form of fishmeal or oil for the animal feeds and chemical industries. Compared to other sectors of the fishing industry a relatively small amount of the pelagic catch is utilised for human consumption. In Namibia and South Africa most of the sardine catch is canned, although as the TAC has expanded in South Africa in recent years a far greater proportion has gone into industrial products. The product is aimed at the lower end of the economic market. The entire anchovy, round herring and juvenile horse mackerel catch is utilised for fishmeal and oil production. In Angola where per capita consumption of fish is higher, a much greater percentage of all species is utilised for human consumption

The midwater trawl catch is either converted to fishmeal or utilised for low-value products including frozen whole round fish and dried fish, which are sold cheaply within southern Africa. Fish consumption in Namibia has traditionally been low, at around 4 kg/capita/year at Independence, one of the lowest of all fish producing nations. In an attempt to change this, the private sector and government, with donor assistance from Japan (through the Overseas Fisheries Co-operation Foundation) have combined to make fish more readily available throughout the country and publicised the benefits of eating fish. This has resulted in more than doubling of the per capita consumption rate by 2002 (MFMR 2002a). According to Clark (1997), in recent years this has produced a major change across southern Africa, improving food security and forcing down the price of beef.

Despite this the Namibian horse mackerel TAC is consistently under-utilised, all anchovy for human consumption is imported from the Mediterranean, while sardine products have remained virtually unchanged for several decades even though higher-priced quality herring products are imported from Europe. These facts all suggest that product diversification may well yield real benefits for the pelagic sector.

It is perhaps interesting to note that Namibia requires that 60 percent of the hake catch is landed as fresh fish for processing onshore. This policy has resulted in the establishment of 20 processing factories in the past decade, creating more than 5 000 jobs (MFMR 2002a).

2.2.2 Safe, healthy and fair working environments

Of the social issues that do emerge in the main international instruments, one is that workers, both on land and at sea, should be afforded safe, healthy and fair working conditions. This is particularly relevant to developing countries where working conditions of the lower paid (including factory workers and fishers) have frequently left much to be desired. Namibia is a member of the International Labour Organization (ILO) and has ratified a number of its conventions. In 1992 Namibia passed a Labour Act, which meets some of the provisions of the ILO, giving workers greatly improved levels of social protection. All three countries of the southeast Atlantic are members of the International Maritime Organization (Angola joined in 1977, Namibia in 1994 and South Africa in 1995) and are signatories to the SOLAS[20] Convention, which requires certain shipboard safety standards to be met and all sea-going workers to have basic safety-at-sea training. Compliance is however believed to be low and a number of accidents during the past couple of years, particularly in Namibia, involving fishing vessels, and deaths resulting from these accidents have alarmed the government and unions alike and further regulations are likely.

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[20] SOLAS stands for "Safety of Life At Sea".

AIDS/HIV[21] is of major concern in southern Africa. The current infection rates of more that 20 percent in Namibia and South Africa are predicted to increase and the social and economic consequences are expected to be massive over the coming decades. While this disease, and other large-scale social disruptions such as drought, war and political upheaval, is difficult to plan for, both Namibia and South Africa have implemented policies to limit and reduce HIV infection rates and to mitigate against the social disruption caused by AIDS and AIDS-related deaths.

2.2.3 Aquaculture as alternative

The Code of Conduct for Responsible Fishing (CCRF, FAO 1995) proposes that states should consider aquaculture as an alternative source of fish. This is particularly topical in Namibia where, with the decline of several of Namibia's pelagic stocks, and the general desire to increase fish productivity, the authorities have recently introduced an aquaculture policy to stimulate and encourage developments in this sector (MFMR 2002b). Several oyster and mussel farms already exist, but a large expansion of this previously neglected sector is being planned. Namibia's uninhabited coastline, highly productive unpolluted waters, and availability of fishmeal, is seen as being highly conducive to aquaculture. Whether a large-scale industry will develop remains to be seen.

Mariculture is also increasing in South Africa where 4 000 tonnes a year is produced, much of this attributable to abalone and mussel production. For the first time, in 2002 abalone farms were expected to produce more than from wild stocks. Development of other mariculture species is also attracting interest, including the farming of salmon in offshore cages.

2.2.4 Assist developing countries

Several of the international instruments state that developed countries are obliged to assist the less developed to implement their fisheries management systems in accordance with the accepted principles of sustainable utilisation. This is of course particularly relevant to the states of the southeast Atlantic where Angola is classified as one of the "least-developed" countries, and Namibia and South Africa as "developing".

Indeed all three countries have received considerable assistance through the FAO and other international organizations as well as nations such as Norway, United Kingdom, Iceland, Germany, Portugal, Sweden, Japan, Spain and others. In Namibia this has been equivalent to approximately one third of the total fisheries management costs (Wiium and Uulenga 2002), although a large proportion has been for human and capital project development and therefore, this assistance is declining as the state institutions mature.

In recent years it has been recognised by politicians and managers in Africa that the continent cannot continue indefinitely to expect aid from the developed countries and that regional cooperation needs to be developed. Out of this concept grew NEPAD (see 2.4.4), which aims to create sustainable growth and development such that the African nations will become equal partners in global trade and assistance will no longer be needed.

Even prior to the concept of NEPAD the three countries of the southeast Atlantic have provided considerable assistance to each other through BENEFIT and BCLME (see 2.4.4). While both of these programmes are largely driven by external funding, much of the research has been of a cooperative nature within the region. Indeed BENEFIT has already had a very positive impact through training and has enabled Angolan scientists to become more involved in fisheries science (SADC 2002).

Various other bilateral arrangements have also been developed, such as assistance from South Africa to Namibia in technically advanced fields of research (stock assessment and acoustics), while Namibia has also reached a Technical Cooperation between Developing Countries agreement with Mozambique, offering preferential treatment for horse mackerel exports to that country in order to improve the food security of the region.

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[21] Auto-Immune Deficiency Syndrome and Human Immunodeficiency Virus.

2.2.5 Equity

One aspect that is seen as crucial to the success of fisheries management in southern Africa is equity. This is particularly relevant in Namibia and South Africa where decades of apartheid has resulted in large sections of the population being denied access to all but the most menial of jobs in industries like fisheries. Similarly, the profits from fisheries have accrued largely to white-owned (often multi-national or foreign) companies with little benefit to local communities.

Disparate educational and work opportunities, and subsequently incomes, are seen as one of the biggest threats to national security and prosperity and hence in recent years considerable effort has been put into redressing the imbalances of the past. The actions that have been taken within the fisheries sector are described below.

2.2.6 Namibianisation

At Independence the newly established government inherited a fishing industry that was largely owned and managed by foreigners, using foreign registered vessels and foreign crew. Most products were either exported in their raw form, or processed at sea. Apart from being a poor country, Namibia also had an unemployment rate of approximately 40 percent. Clearly Namibians needed to not only take control of their own national assets, but also to benefit from them, both in terms of income and employment. To this end a policy of Namibianisation was introduced to the fisheries management system; a system designed to redress the injustices of the past and to ensure equity between all racial groups within the country.

In essence this system was designed to advantage Namibians through rights and quotas, which are allocated preferentially to applicants who inter alia:

- are Namibian, or if a company, 90 percent Namibian-owned,
- have vessels owned by Namibians and
- work towards the advancement of previously disadvantaged persons.

In addition, substantial economic incentives are also in place to further encourage rights holders to increase the involvement of Namibians in fisheries. Quota levies are charged for all managed species. These are paid in advance and are charged per tonne of quota allocated to the right-holder. As an example in the hake fishery the quota levies per tonne are as follows.

Basic levy	N$880
Vessel Namibian flagged	N$660
80% Namibian crew	N$440
Fish processed on shore	N$220

As a result of these policies, of the 171 rights holders all except one are currently majority Namibian-owned. The proportion of horse mackerel quota in Namibian hands has risen from 14 percent at Independence to around 80 percent in 2002 while the other small pelagic quotas are entirely in Namibian hands. The proportion of Namibian vessels has increased from 50 percent in 1991 to around 80 percent and Namibian crew on fishing vessels has increased from 42 percent to 65 percent between 1994 and 2000, with most sectors being over 80 percent (MFMR 2002a).

In the early years after Independence a small proportion of the TAC of each species was set aside for newcomers in a further effort to increase local involvement in the industry. This had limited success due to many of the newcomers leasing their quotas for immediate gain. Therefore, a new policy has recently been implemented whereby established rights holders are required to enter into partnerships with newcomers. Approximately half of the companies involved in fisheries are now "newcomers" while restructuring of many of the established companies has further increased the degree of Namibian participation in the industry.

In practice however, while quotas are not officially transferable, the established companies have often entered into unequal partnerships with newcomers to obtain access to extra quota, resulting in limited direct participation in the industry by newcomers (see below) and concerns about the true level of Namibian control of fishing quotas (Manning 2000).

2.2.7 South African transformation

When the new democratically elected government of South Africa assumed control of the marine resources in 1994, there was a clear need to promote equity in the fishing industry, in line with the "transformation" process that was taking place in all spheres of society. The aim of the authorities was to build a fishing industry that broadly reflected the demographics of South Africa in its ownership and management (Government Gazette No. 22517, 2001). Since 1996 the government tried to implement this policy by allocating fishing rights to "historically disadvantaged individuals" (HDIs), without unduly penalising established companies that were important providers of employment and economic activity in coastal areas. This was problematic as the major commercial fisheries were already fully utilized and thus rights that were allocated to black-owned small, medium and micro-enterprises (SMMEs) often were so small that they were not economically viable (Moosa 2002).

A new system was implemented in July 2001, whereby applications for medium-term rights of four years were be allocated. By this time most established companies had restructured ownership towards meeting criteria relating to transformation and many had a significant black shareholding, and this was recognised in the rights allocation process. The applications were assessed by a fishery-independent advisory committee, and scored according to various criteria, including the degree of transformation, involvement in the fishery, capacity to harvest and process the resource, creation of employment, past performance and the degree of "paper quota" risk.

As with Namibia, the beneficial ownership of many companies is difficult to ascertain, but at least on paper this process has been fairly successful. For example, just twenty years ago the South African hake trawl TAC was shared between six white-owned companies, while now 73 percent of the rights are majority-owned by HDIs. The pelagic sector is over 75 percent majority HDI-owned (DEAT 2002a).

2.3 Economic component of sustainability

The major international fisheries management instruments have been summarised into three main economic components in the analytical framework. These are briefly reviewed below.

2.3.1 Balancing fishing capacity with resource yield

The objective of balancing fishing capacity with the yield of fish stocks is clearly stated in many of the international instruments.

At Independence one of the first actions taken by the Namibian government was the exclusion of more than 100 foreign fishing vessels from the EEZ (Nichols submitted), considerably reducing the fishing pressure on the ground fish stocks. Since then the Namibian management system has been one of output controls rather than input and therefore capacity is only loosely controlled. In new experimental fisheries however, a precautionary approach is applied to capacity build-up.

In an effort to reduce capacity, and maximise local involvement in the fishing industry, South Africa has recently terminated a long-standing agreement for Taiwanese vessels to fish tuna in South African waters, while Japanese vessels have been reduced from eighty-two to sixty-nine. The authorities have also recently refused to allow European Union (EU) vessels to fish in their waters (DEAT 2002a).

While excess capacity has been identified as one of the major (if not the main) causes of unsustainability, the Law of the Sea (Art. 62, Para 2, 1982) requires that states should make any excess yield available if the nation does not have the capacity to utilise it. For developing states this is somewhat problematical as in some cases fleets are being built up slowly in an attempt to match effort with yield, rather than to overshoot this critical balance. Given that the yield of fish stocks is highly variable and the assessment of fish stocks imprecise, it is often difficult to determine with any certainty whether a stock is genuinely under-fished. A case in point is the Namibian horse mackerel resource. During the past decade the catch has routinely been 15 percent (65 000 tonnes per annum) below the TAC, promoting fears within the government that foreign fleets may lay claim to the unutilised yield.

However, some attempts have been made within the region to match regional capacity with available resources. In 2002 South Africa's sardine and anchovy TACs were increased by 80 percent to record high levels, above the capacity of the local purse seine fleet. Conversely, Namibia's sardine and anchovy stocks are at historically low levels. The Namibian purse seine fleet has contracted drastically in recent years: in 1999 there were still around 40 vessels in operation, whereas this had decreased to around 13 by 2002, but even these vessels are severely under-utilised while the canning factories (and crucially factory workers stand idle). An agreement was reached whereby Namibian purse seiners, under-utilised due to the zero TAC for Namibian sardine, could apply for licenses to assist South African companies to land their quotas. This was seen as "an example of how the New Partnership for Africa's Development promotes innovative partnerships for the development of the African continent and forms the basis for a sustainable development programme for Africa" (South Africa's Minister of Environmental Affairs and Tourism, Mohammed Valli Moosa). Similarly, about 50 South African fishing vessels are licensed to fish in Namibian waters, primarily in the large pelagic fishery.

In Angola the state of the small pelagic stocks is less clear, but a recent workshop on the small pelagic fish of Angola, Congo and Gabon concluded that Angola's sardinella stocks are underexploited while the horse mackerel *T. trecae* stock is probably harvested at around MSY. The catch of small pelagics decreased sharply with the collapse of the Soviet Union in 1992, although it has recently started to increase again. Although the national "commercial" fleet consists of about 200 vessels, including ten purse seiners, many are not in working order as a consequence of the war, resulting in a lack of local capacity to harvest the small pelagic resources.

There are currently about ten Namibian-flagged purse seiners with licences to catch small pelagics in Angolan waters. This was initiated in 1995 when an unusually large part of the Namibian-Angolan shared sardine stock was located in Angolan waters and the Namibian purse seine fleet obtained licences to continue catching sardine in Angolan waters once the Namibian TAC was filled. This bilateral agreement included Angolan vessels being given access to Namibian hake quota. Since the collapse of the sardine resource, these vessels have remained in Angola fishing on the apparently under-utilised sardinella and horse mackerel for a Namibian-funded fishmeal plant.

However, most of the under-capacity in Angola is taken up by distant-water fleets. In July 2002 it was announced that the Russian fleet is allowed to catch 300 000 tonnes of mostly small pelagic fish like horse mackerel. In addition the fisheries agreement between Angola and the EU, first signed in 1987, was updated in August 2002 and will continue until 2004. This agreement allows 22 shrimp vessels, 15 tuna seiners, eighteen surface longliners, an unspecified number of demersal vessels up to 4 200 GRT, and two small pelagic trawlers, to fish in Angolan waters. Apart from shrimp, there are no catch limits, and the effort limits can be increased if both parties agree and contributions are made towards the improvement of Angola's fishing industry. In return 35 percent of the U$15.3 million agreement is earmarked for projects that benefit the local fishing industry, and other benefits include training, institutional support in regional fisheries organizations, MCS and aquaculture. Whether this agreement conforms to the Law of the Sea (Art. 62, Para 4, 1982) is unclear, but it has been strongly criticised by conservation groups for its non-sustainability, lack of catch limits and the fact that effort limitations are not based on scientific advice. There are also concerns that Angola does not have the infrastructure to ensure that area limitations are observed, putting the local artisanal fishery at risk (Lankester 2002).

2.3.2 Trade must be conducted according to WTO rules

Many of the international instruments call on states to conduct trade without artificial subsidies or restrictive barriers. In contrast to many fishing states both the South African and Namibian fisheries operate without subsidies. Financial support is offered in the form of fuel tax rebates for certain sectors of the industry, e.g. the Namibian horse mackerel fleet, to enable them to compete with foreign-registered vessels that obtain fuel tax-free, while the South African fishing industry does not pay the "road levy" normally charged on fuel in that country. Also, although not a direct subsidy, South Africa has over the years put various structures in place to assist with the acquisition of capital for investment in the fisheries sector.

Many countries have developed heavily subsidised fisheries, which as noted at the previous workshop has exacerbated over-capitalisation and hence over-fishing. Namibia has, since Independence, taken the view that the marine resources should be harvested to the benefit of all Namibians, and therefore fishers are required to pay a quota levy for the right to harvest these resources. These levies have broadly been calculated as being about 15 percent of the landed value of the fish. In 1994 this percentage was realised, although by 1999 it had decreased to about seven percent (Table 2), largely as companies were charged the reduced levies for becoming more "Namibianised" (see 2.2.4). Even after the cost of fisheries management has been deducted Namibia has a positive resource rent[22], calculated at about three percent of the landed value of the fish in 1999. This is believed to be one of the highest resource rents in the world (Wiium and Uulenga 2002). However, as MCS costs are expected to increase in the future with the imminent acquisition of a third patrol vessel, it is possible that resource rents may soon become negative.

Table 1. Total government receipts from the Namibian fishing industry (N$ '000s)

	1994	1995	1996[23]	1997	1998	1999
Quota fees	108 000	90 600	45 500	72 200	75 200	91 000
By-catch fees	9 600	8 000	14 800	5 000	6 200	9 000
Research & training	8 600	7 200	6 100	8 300	9 900	13 300
Licence fees	30	162	162	158	160	172
Total	131 830	111 093	72 000	91 029	97 259	119 598

One of the penalties of a resource rental system is that the incentive to cheat becomes much larger, which requires good control. In addition to Namibia's effective MCS system, it is believed that legal rights holders have become more protective of their resource since these levies were introduced and the level of self-regulation has increased as illegal competitors are soon reported to the authorities.

Poor nations are often perceived as unequal partners in international trade as the examples in 2.3.1 illustrate. However, exchange rates tend to appreciate in rich developed countries relative to developing countries, and, if resources are well-managed, can result in the balance of trade being to the benefit of developing countries. This has certainly been the case in Namibia and South Africa where the local currency has devalued approximately four-fold in the past ten years. This creates an even greater incentive to export products, and brings more foreign exchange for the country. However, this also increases the pressure on local authorities to raise quotas, resulting in increased likelihood of unsustainability, and reduced food security as the fish products become too expensive for the local market.

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[22] Resource rent is used here in the context of revenue (to the government) in excess of costs.

[23] Note that 1996 followed a Benguela Niño year (an intrusion of warm unproductive tropical water similar to the Pacific El *Niño*) when the marine system was disrupted by anomalous environmental conditions and some sectors of the industry were given relief in the form of reduced quota levies.

A further issue concerned with trade of fish that affects developing countries is transfer pricing of products by vertically integrated foreign-owned companies. This is believed to result in a significant loss of revenue for Namibia, especially with respect to hake caught by companies exporting to Spain (Manning 2000).

2.3.3 Prevention of trade in IUU fish[24]

The FAO International Plan of Action on IUU fishing calls on nations to prevent trade in fish from IUU vessels, and as a ratified signatory Namibia has enacted the necessary laws to prevent such activities. Namibia and South Africa have also supported the ICCAT resolution to draw up a black list of vessels flouting ICCAT control, while SEAFO and the SADC Protocol on Fisheries also provide further tools to prevent IUU vessels operating within the southeast Atlantic.

In the past vessels that have been involved in IUU fishing for toothfish and other deepwater species on the high seas (especially the CCAMLR region) have occasionally visited Namibian ports, and a Namibian registered vessel was reportedly engaged in IUU fishing during 2001. The Namibian authority has taken a serious view on such illegal fishing activities and has taken steps to ensure that any vessel engaged in IUU fishing will be apprehended and suitably penalised. Indeed Namibia is in the unusual position in that recently promulgated fisheries legislation gives the authorities control over Namibian flagged vessels operating outside of national waters and also effectively prevents IUU vessels from landing their catch in Namibian ports.

South Africa is estimated to have lost over N$ 3 billion in revenue since 1996 as a result of IUU fishing of toothfish in its EEZ waters around its Southern Oceans islands (GPF 2002). Therefore, all foreign-flagged fishing vessels landing in South Africa ports are required to have “gear” and “prohibited deepwater species” permits. Further, South African-flagged vessels fishing in international waters require a “high seas” permit (FAO 2001c).

2.4 Institutional component of sustainability

The analytical framework divides the institutional components of the international instruments into six broad themes, of which the first five are of particular relevance to overfishing in large-volume small pelagic fisheries.

2.4.1 Fisheries management should use the best available scientific evidence

The requirement that fisheries management should use the best available scientific information, including socio-economic and traditional knowledge, is clearly stated in virtually all of the international instruments. Recognising the importance of reliable and accurate scientific data, Namibia and South Africa have developed or re-structured their fisheries research institutes during the past decade or so to meet the demands of modern fisheries management. Angolan fisheries research on the other hand has been hampered by poor wages and lack of facilities (including a research vessel) and has had to place greater reliance on foreign assistance for direct information on the state of fish stocks (SADC 2002, Hampton *et al.* 1999).

While the governments of the southeast Atlantic region tend to follow scientific recommendations to a large extent, these TAC recommendations focus on the biological status of the stocks, while socio-economic aspects tend to be neglected. Both countries manage their fisheries through top-down state control systems and until recently stakeholders have not been included (at least formally) in the management process. In recent years, however, the industry and other stakeholders have been partly incorporated into the management system. In contrast, in Angola there is little communication between the Ministry and private sector (SADC 2002).

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[24] Fish caught through illegal, unreported or unregulated fishing activities.

For example the Namibian authorities have attempted to incorporate some sectors of the fishing industry into the management process in a formal manner, based on the rationale that they can contribute to the process, and to ensure that the industry has a part-ownership of any decisions taken. The main mechanism for this has been through the establishment of working groups that have been formally mandated to participate in the analysis of biological data for most fisheries. The authorities have limited the concept of co-management to a rather narrow range of stakeholders, i.e. the managers of the fishing companies and, occasionally, employees. Fishers, factory workers, financial institutes, unions, other (competing) fisheries, conservation bodies, etc. are either not formally consulted, or are only included very late in the process. South Africa has taken this concept somewhat further, in that working groups are also mandated to develop structured management procedures (see below).

Fishing associations have been formed to represent each of the major sectors of the fishing industry in Namibia. While these associations have often acted as the de facto negotiators with the government, they have not been given any formal role in the fisheries management system. In recent years ad hoc meetings have also been held between the Namibian Ministry and the industry prior to the implementation of management decisions that may have far-reaching consequences to the stakeholders. These have taken the form of periodical consultative meetings, where some proposed management action is explained to the industry, but with limited opportunity for input (Olsen submitted).

South Africa has recently embraced co-management as part of their new fisheries management policy (Hauck and Sowman 2001), however, this is more to ensure equitable distribution of South Africa's marine resources, rather than to improve the sustainability of the resources. In fact, it must be noted that as is often the case, the South African attempts at introducing co-management into their management system is primarily for small-scale fisheries.

South Africa is in the process of developing long-term management plans, which include operational management procedures (OMPs) for all of the major resources. These plans are being developed through consultation with all stakeholders and include MCS provisions as well as the socio-economic implications of different quota levels (FAO 2001a). An OMP has been used in the pelagic sector since 1991. This consists of setting the TAC according to harvesting rules that give an appropriate catch versus risk trade off. Uncertainty is included by requiring rules that provide robust performance over a range of plausible scenarios for resource status and dynamics (De Oliviera 2001).

The cost effectiveness of any management system is a fairly subjective judgement. The cost of the Namibian management system has been around 6 percent of the landed value of the fishery for most years since Independence, although as TACs and fish product value has increased in recent years this had declined to 3.6 percent in 1999. Alternative management systems have not been evaluated, although given the relatively short time that the current system has been in place, and its apparent success, this is not surprising.

The pressure for companies to become "Namibianised" and the restriction on quota transfers or sales, has resulted in complex company structures such that the true beneficial ownership is unclear, often being large companies (foreign-owned) when on paper Namibians are the beneficiaries. This allows the companies to reduce their quota levies as they can claim that the quota is being fished by Namibian majority-owned companies. Manning (2000) suggests that an ITQ system will firstly legitimise this system of "trading" in quotas, but also greatly simplify determining the real power behind quotas, thus enabling the appropriate resource rent to be extracted.

2.4.2 Precautionary approach

The precautionary approach has become prevalent in virtually all of the recently formulated international instruments. The management authorities of the region have all stated the intention of implementing precautionary strategies, but to date this has not been done in any formal way. The precautionary approach has been incorporated into the SEAFO Convention, although how it will be implemented is not described.

The precautionary approach is therefore applied in an ad hoc manner with some decisions being precautionary while others are not. Within the Namibia system there seem to be no clear examples of the precautionary approach being applied to the small pelagic fisheries, and consequently the stock has declined to such low levels that it may take many years, or even decades, to recover.

One aspect that is clearly stated in CCRF (7.3.3) is that management plans are an integral part of the precautionary approach. Namibia has developed a management plan for orange roughy, and OMPs for hake and seals, while NPOAs are being drafted for seabirds and sharks. As described in 2.4.1, the South African authorities have introduced OMPs for the sardine and anchovy fishery, as well as the hake and rock lobster fisheries, and are in the process of developing full management plans. Similarly, reference points are another element of the precautionary approach (e.g. see CCRF 7.5.3). While some reference points have been proposed for a number of species, none have yet been formally recognised in Namibia.

2.4.3 MCS[25] in the EEZ and on the high seas

The call for states and RFMOs[26] to establish effective monitoring, surveillance and control systems is repeatedly stated in the various instruments. Angola, Namibia and South Africa have had rather variable success at implementing effective MCS. Namibia was perhaps even more aware of the necessity for effective control of fishing activities as the newly-elected government inherited fish stocks that had been systematically depleted. It is estimated that of the 8.6 million tonnes of hake caught in Namibian waters prior to Independence, only 0.004 percent of the value found its way into Namibia (Nichols submitted). The third act passed after Independence was the proclamation of the 200 nm EEZ, indicating the importance attached by the government to responsible management of the marine region. This was followed in 1992 by the Sea Fisheries Act that was drafted for this newly established coastal state to take full control over its own resources and build up Namibian involvement in the industry. Subsequently Namibia signed various international fisheries management instruments that placed new obligations on the government that were not covered in the 1992 Act. Thus in 2000 a revised act succeeded the original one, incorporating the key elements of these instruments.

Concurrent with the development of the legislature to manage fisheries responsibly, Namibia's MCS system was developed. This is based on having observers on all but the smallest fishing vessels to monitor compliance and collect vital research data, sea patrols to enforce compliance and air patrols to detect unlicensed vessels. Transhipments at sea are not permitted and all landings are monitored at the two commercial fishing ports, while discarding of by-catch is not permitted (see 2.1.3). A vessel monitoring system (VMS) is currently undergoing field tests and will be implemented during 2003.

Illegal fishing within Namibia's EEZ is believed to have been virtually eliminated as only one incident has been recorded since 1995 (MFMR 2002a). Despite the extent of the Namibian MCS system it has been estimated that its cost is currently less than four percent of the landed value of the fisheries (Wiium and Uulenga 2002).

Monitoring, control and surveillance in Angolan waters was improved considerably with the installation of a VMS system in July 2000, which is applied to approximately seventy trawlers, although there is still a lack of patrol capabilities, especially in the most productive southern provinces, which limits it effectiveness. Lack of means for maintenance has put small patrol vessels out of action, and there is no long-range patrol vessel (SADC 2002). A key problem is the encroachment of trawlers into the 12 nm coastal zone designated for artisanal fishers, resulting in competition for resources and destruction of gear. Conflicts have escalated in recent years, with Spanish trawlers targeting shrimp and demersal fish implicated in many of the disputes (Lankester 2002), although competition for horse mackerel is also a problem (Sardinha 2001).

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[25] Monitoring, control and surveillance.

[26] Regional Fisheries Management Organizations

In South Africa 126 Marine Conservation Inspectors are responsible for law enforcement along a 3 500 km coastline and a 200 nm EEZ, an area in excess of 1 000 000 km^2. In addition South Africa has distant water fishery responsibilities in the Marion/Prince Edward Island group. The vessels at their disposal are three old and unreliable patrol boats, with a 40 nm offshore limit, a few ski-boats and inflatables. Thus the South African authorities have not been able to conduct any offshore patrols since 1994, although fisheries inspectors are sometimes able to use naval vessels for patrols, and the South African Air Force carries out maritime patrols, including surveillance of fishing vessels.

A fishery compliance workshop held in 2000 identified problems in each fishery sector, and for the pelagic fishery these included widespread discarding as a result of a quota on sardine, size selection and by-catch limits; illegal fishing in closed areas; inadequate procedures for estimating catch composition; faulty weighing machines at offloading sites; attempted bribery of offloading control officers; and inspectors being provided with insufficient information concerning quota allocations (MCM 2000).

The situation has been receiving attention, and in order to increase manpower available for surveillance activities, cooperation with other law enforcement agencies has been improved, and control of landings is being outsourced to free up inspectors for patrols. In 2002 tenders were awarded for one offshore and three inshore patrol vessels, and a VMS system is planned for all commercial fishing vessels; the same system that is being implemented in Namibia.

2.4.4 States should cooperate

Lack of cooperation between states has been identified in some regions as a primary cause of overfishing, e.g. in European Union waters (Payne and Bannister submitted). In general cooperation between Angola, Namibia and South Africa is good, although the only formal bilateral agreement is between Namibia and Angola, who have only signed a Memorandum of Understanding to cooperate in fisheries research. Several regional agreements have recently been signed. The most important of these as far as fisheries within EEZs is concerned is the SADC Protocol on Fisheries, which was signed in August 2001 by the fourteen SADC members, although to date it has not yet been ratified by all. This protocol emphasises the “importance of fisheries in the social and economic well-being and livelihood of the people of the region, notably in ensuring food security and the alleviation of poverty” and aims to “promote responsible and sustainable use of the living aquatic resources and aquatic ecosystems of interest to State Parties…” It includes articles on international relations, management of shared resources, harmonisation of legislation, law enforcement, access agreements, high seas fishing, artisanal fisheries, aquaculture, protection of the environment, human resources development, trade and investment, science and technology, and information exchange, and closely follows internationally accepted practices as outlined in the major conventions.

While not strictly relevant to the near-shore small pelagics stocks, a notable recent development is the Convention on the Conservation and Management of Fishery Resources in the South East Atlantic Ocean, signed in April 2001 by Angola, the European Community, Iceland, Korea, Namibia, Norway, South Africa, United Kingdom (in respect of St. Helena and its dependencies) and United States. This convention aims to ensure the long-term conservation and sustainable use of high seas fishery resources in the convention area and straddling stocks (excluding tunas, which are covered by ICCAT), through the establishment of the South East Atlantic Fisheries Organization (SEAFO). This is the first RFMO established in terms of the UNFSA (Doulman 1999; Nichols submitted). The member states intend to cooperate to manage the fishery resources of the area, using the best scientific advice and on the basis of the precautionary approach. A scientific committee will be set up to promote research and formulate specific rules for the collection and analysis of data. Measures will be adopted concerning control and enforcement within the convention area, and a compliance committee will give advice and recommendations on matters pertaining to conservation and management measures. Duties of flag states and port states are laid down. Full recognition is to be given to the special requirements of developing states in the region with respect to the conservation, development and management of fishery resources.

The third international agreement worth mentioning here is the New Partnership for Africa's Development (NEPAD). This declaration arose from initiatives presented to the OAU[27] for the recovery and development of Africa and was adopted as Africa's principal agenda for development, providing a strategic framework for the socio-economic development of the continent, within the institutional framework of the African Union. While the principle of partnership with the rest of the world is equally vital, it must be based on mutual respect, dignity, shared responsibility and mutual accountability. The expected outcomes include:

- economic growth and development and increased employment;
- reduction in poverty and inequality;
- diversification of productive activities;
- enhanced international competitiveness and increased exports;
- increased African integration.

Whether NEPAD will have significant impacts on fisheries management in the near future is unclear, although it apparently helped Namibia's request to allow its purse seiners access to South African sardine stocks (see 2.3.1).

Within the research field several cooperative initiatives have gained widespread praise. The Benguela Environment and Fisheries Interaction and Training Programme (BENEFIT) is a ten-year research programme that was started in 1997 by Angola, Namibia and South Africa, with several donor countries as cooperating partners, notably Norway and Germany. The overall goal of BENEFIT is to promote the sustainable utilisation of the living resources of the Benguela Current Ecosystem. As outlined in the 1997 Science Plan, this goal is to be achieved through an active science and technology programme integrated with capacity building within the Benguela region. Research is centred on fish resource assessment and monitoring of the environmental parameters related to the natural variability of those resources (from www.benefit.org.na).

A second programme that was also initiated by the three coastal states of the Benguela system is the Benguela Current Large Marine Ecosystem Programme (BCLME). This programme started in 2002 and aims to develop an integrated and co-ordinated ecosystem management approach. It is concerned with all activities relating to the marine system, including fisheries issues, the effects of other marine activities such as seabed mining, oil exploration and production, and coastal zone activities (for more information see www.ioinst.org/bclme).

Namibia and South Africa are also both full members of the two RMFOs; ICCAT and CCAMLR, while Angola is also a member of ICCAT.

2.4.5 Decisions should be transparent and states should make people aware of responsible fisheries

As noted in section 2.4.1, fisheries management in the Benguela region has been typically state dominated and top-down in structure. Involvement of stakeholders has been ad hoc and generally not formally structured. Section 2.4.1 also described some attempts by the national authorities to create greater participation in the management systems. Another aspect of transparency is the rights allocation process.

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[27] OAU is the Organization of African Unity. This has recently become the African Union.

For decades the South African fishing industry was controlled by a few large, predominantly white-owned companies, and allegations of racism, nepotism and corruption were made concerning the allocation of rights. Government initiatives to increase black participation since 1996 resulted in litigation and limited success (from DEAT 2002b). There was obviously a need to revise the system, and in order to gain public support it had to be fair, but more importantly, it had to be seen to be fair. To this end the process was designed to be as transparent as possible.

A call for medium-term rights applications was made in 2001 and despite increasing the non-refundable application fee from N$ 100 to N$ 6 000 over 5 000 were received. Crucially, a set of policy guidelines was broadly advertised alerting applicants to the specific criteria that needed to be met. A Rights Verification Unit, an independent auditing firm, was set up, to receive the applications, verify the information submitted and to instil confidence that applications would not be lost or tampered with. The applications were then assessed by at least two members of an independent advisory committee, which consisted of people with no interests in the fishing industry. Finally the Ministry decided whether or not to allocate a right and all decisions were made public. Unsuccessful applicants had the right to appeal.

At the end of the process there was general agreement amongst the industry and the coastal communities that, although not perfect, the process was greatly improved, more balanced and more transparent than ever before (Moosa 2002). Despite this move towards transparency in the rights allocation system, the state has still been embroiled a series of litigations and a current case, if lost, may require the reallocation of the entire hake quota. Additionally, the public have complained that the "rules" for awarding rights were not made public and indeed the Marine Living Resources Act (RSA 1998) gives the Minister sole power in granting such rights. This final issue is similar to the Namibian system in which selection criteria "leaves a large measure of discretion to the Minister in granting rights" (Manning 2000).

2.4.6 Fisheries should be included in coastal management plans

This final aspect of institutional concerns is seen to have limited applicability to large-scale offshore fishing activities in comparison to many of the other issues addressed. Much of the southern Angolan, Namibian and South African west coastal region is desert with limited development or activities. The impacts of large-volume pelagic fisheries tend to be concentrated at the coastal harbours. The major fishing harbours of this region (in South Africa and Namibia) have environmental management plans and one of the major areas of concern is the industry's large demand for fresh water.

Multisectoral management plans are needed between the diamond mining and fishing sectors in Namibia and South Africa, and the oil and fisheries industries in Angola. For example, the oil industry in Angola is one of the mainstays of that country's fragile economy, so full protection is given to offshore oilfields, even when this excludes fisheries activities from large areas. Thus there has been a conscious decision to forego fishing in return for oil.

3. WHY IS FISHERY MANAGEMENT SUCCESSFUL (OR NOT)?

In general it can be concluded that there have been some notable successes in the recent management of fisheries resources in the southeast Atlantic, but equally that other resources have failed to respond to apparently rational, conservative management strategies.

Namibia and South Africa have many factors favouring successful and sustainable utilisation of their living marine resources. They both have strong legal frameworks based on the major international fisheries management instruments, backed by political will, and this legislation is implemented relatively effectively. The countries have cooperative neighbouring states and a fairly discrete physical system with limited sharing of stocks with other countries. Most international conventions, agreements and codes of conduct have been ratified giving the authorities the legal (and moral) basis with which to manage the resources.

During the past decade or so, the re-building of depleted and overfished stocks has been encouraged through strictly enforced management controls, including TACs, minimum mesh sizes, closed areas and seasons and measures to restrict by-catches and discards. Several stocks are now showing signs of a sustained recovery, and annual catches have been allowed to increase. Other stocks, notably Namibian sardine, remain depleted.

Due to decades of civil strife, Angola has been unable to devote the necessary resources to effective management of its fish resources. The national fishing fleet has become dilapidated due to lack of capital and foreign fleets catch much of the country's offshore fish. Although TACs are set, there is a lack of means to ensure compliance.

The International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries ("the Bangkok Workshop")[28] noted that the factors causing unsustainability could be grouped into six general types. This grouping is used below to illustrate how some of these factors affect the small pelagic fisheries of the southeast Atlantic and how the management authorities have dealt with them.

3.1 Inappropriate incentives

The region has come out strongly against providing subsidies to artificially support fisheries. Indeed a resource rent is extracted which, at least in Namibia, provides a positive return on fisheries management costs.

The ban on discarding of fish and the charging of by-catch levies to reduce targeting on other species has successfully reduced by-catch.

ITQs promote efficiency, but tend to work against equity. Hence in countries with a history of inequity such quota systems may be counter-productive and have hence been avoided.

3.2 High demand for limited resources

Large incentives are offered by rich countries to the poorest of nations (in this case, Angola) in order to gain access to fish resources. This may be creating excess capacity, possibly leading to overfishing.

3.3 Poverty and lack of alternatives

Fishing is an important component of either the national or provincial economy in all three countries. Therefore there are very strong incentives to create sustainable fisheries industries. However, this means that measures to reduce fishing activities are difficult to implement due to the short-term losses in jobs and revenue.

Lack of social and economic equity is a major factor in the region and drastic measures are being taken to redress the imbalances of the past.

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[28] Held under the FAO/Japan Government Cooperative Programme, 4-8 February 2002, Report and documentation in FAO Fisheries Report No. 672, FIPP/R672.

3.4 Complexity and inadequate knowledge

In comparison with many marine systems, the functioning of an upwelling system is relatively simple. However, the system is still poorly understood and important questions remain unanswered, such as whether the northern Benguela has undergone a regime shift, which may mean that attempting to recover the small pelagic stocks back to levels of historic abundance may not be feasible. There is generally insufficient knowledge to attempt to implement the concepts of multispecies or ecosystem management.

Small pelagic stocks that shoal densely often remain profitable to harvest, even when severely depressed as, in contrast to other types of fisheries, the CPUE remains high even at very low stock sizes. Therefore, there is a risk of the fishery becoming biologically unsustainable before it reaches economic unsustainability.

Uncertainty, whether process, observation or model uncertainty, is often used to rationalise maintaining or increasing TACs, instead of applying the precautionary approach.

Several large international research programmes (BCLME and BENEFIT) are addressing these issues.

Socio-economic studies are neglected, although once again BCLME aims to redress this.

3.5 Lack of governance, attention, will, authority

Constitutional and policy statements clearly call on governments to implement sustainable management and the main mechanisms to accomplish this have been implemented.

Both Namibia and South Africa are ruled by strong governments that gained far more than half of the electoral support in their most recent elections. This means that the authorities are strong enough to resist calls for compromise decisions, as illustrated by the recent closure of the Namibian sardine sector. In addition they are both new governments, which make it easier to introduce new policies.

In Angola, the conflict situation has been an overriding impediment to effective management.

Some stocks, which are unmanaged, could become valuable resources if managed sustainably.

3.6 Externalities

Probably the most important external driving force for small pelagic fisheries is environmental variability and in particular the occurrence of oceanographic anomalies, such as Benguela Niños. It is believed that these may cause even the best management policies to fail. Long-term cycles in climatic conditions, or even long-term climate change, will further alter the productivity of stocks, possibly resulting in regime shifts.

The above summary compartmentalises the factors causing unsustainability in fishing implying that each one can be addressed and solved individually. As noted in Cunningham and Maguire (2001) natural variation in stocks will always occur, but this will be more serious if periods when the stock is externally stressed, such as during Benguela Niño events, coincide with periods of overfishing.

4. HOW CAN THE DIFFICULTIES AND OBSTACLES BE OVERCOME?

This review concurs with the Bangkok Workshop (Gréboval 2002) that in general the main problem of unsustainability in fisheries is not a lack of instruments but a lack of effective implementation of these instruments. The main body of this review (Section 2) illustrated some of the successful fisheries management actions taken in the large-volume small pelagic fisheries of the southeast Atlantic, and cases where management has not been successful. The more important lessons learned are briefly summarised below using some of the paths to solutions identified in the Bangkok Workshop.

4.1 Rights

Single species individual rights and quotas are issued with considerable success for most fisheries in the southeast Atlantic. There is some debate as to whether these should be transferable (or indeed whether in practice they already are).

Recent concepts of population stewardship rights, whereby reductions in catches of mature fish would result in the right holder receiving a larger proportion of the TAC of future generations, could be considered.

Clear and fair guidelines on how to allocate rights of shared stocks between states are needed. Currently such arrangements, if any, tend to be ad hoc.

4.2 Transparent, participatory, management

Namibia and South Africa have made some moves towards including the industry in the management of their resources. This has tended to be limited to the major players in the various industries and may need to be more inclusive of all stakeholders. It has also often tended to be rather informal.

Namibia has instituted a method of limiting by-catch, requiring the industry to create “closed areas” if by-catches reach certain threshold levels. This has created a sense “ownership” and is believed to have been implemented with greater effectiveness than a top-down method of control.

The role of fishing associations as a principal voice in negotiations has been implemented although this still needs to be formalised.

The formulation of National Plans of Action and fisheries management plans, in support of the FAO International Plans of Action, needs to be implemented with some urgency.

4.3 Support – science, enforcement, planning

Enforcement seems to be fairly well implemented in Namibia, while South Africa and Angola are making progress.

Arrangements need to be made for regional co-operation in MCS, including reciprocal arrangements between countries to combat IUU activities, hot pursuit, etc.

Variability in the status of fish stocks, and uncertainty in assessing this status is a major problem with small pelagics. Successful management requires a reasonable understanding of the dynamics of the system. International cooperation, and in particular assistance to developing countries may be needed to achieve this.

Most research and planning are directed towards understanding the biological dynamics of the system. Socio-economic aspects of different management strategies and even the effect of changes in the TAC are poorly understood and can only be considered in a qualitative way.

4.4 Benefit distribution

Improving equity and redistribution of wealth are major goals of both the Namibian and South African governments. This is seen to be of major importance in implementing successful fisheries management in the southeast Atlantic, although in the short-term this may reduce the economic efficiency of the industry.

Aquaculture has been identified as a possible supplement to wild marine fisheries, although it is currently uncertain as to whether this form of fish production will be economically viable in the three states.

Value adding promises an opportunity to increase income from the resources.

4.5 Integrated policy

While South Africa has made progress in implementing operational management procedures for many of its major fisheries, there is generally a lack of clear fisheries management plans for virtually all the fisheries in the region. Interrelationships between the various factors that cause unsustainability are poorly understood and a major research programme has recently been initiated by the countries of the region to address this.

4.6 Precautionary approach

Precautionary management is often claimed, but seems to be rarely implemented in any formal or consistent manner. It is generally believed that this approach may be less important during periods when small pelagic fish stocks are in an increasing phase, but during critical periods (such as in Namibia at present) it becomes imperative.

5. CONCLUSIONS

Below are several aspects of the international fisheries management instruments that we feel could be strengthened to make them more effective.

These instruments express many ideals that if complied with would almost guarantee sustainable fisheries management. However, there are many socio-economic pressures on decision-makers that all too often lead to these ideals being sacrificed for the sake of shorter-term gains. Instruments are more likely to be adhered to if there are clear economic gains.

In some cases this may mean that trade with countries that do not manage their stocks sustainably should be restricted. Issues such as eco-labelling (e.g. following the scheme developed by the Marine Stewardship Council) need to be investigated, although such schemes must be fair and transparent.

While the intentions of the precautionary approach are excellent, the guidelines tend to be rather vague and are voluntary. States should be required to develop clear fisheries management plans that include explicit precautionary principles.

Whereas benefits can be offered to poor and developing countries for the right to fish in their waters, protection against relocation of excess fishing capacity from developed nations needs to be strengthened.

Despite Namibia having an acclaimed management system, including effective MCS, the sardine and anchovy stocks are in a severely depleted state. In contrast, South Africa’s stocks are fully recovered, despite very similar management policies. Thus, to misquote Cunningham and Maguire (2002), it seems that while good management may be a precursor to sustainable fisheries, it is no guarantee. External effects also play a significant role and until these are understood, and incorporated into management policies, unsustainable fisheries are likely to recur.

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DISCUSSION PAPER 2

THE MANAGEMENT OF THE SMALL PELAGIC FISHERY IN CHILE

by

Alejandro Zuleta V.[29]

Summary

The factors that have determined the sustainability of the small pelagic fishery along the coast of Chile in the south-eastern Pacific are discussed according to the guidelines provided by the coordinators of the Second Workshop on Factors of Unsustainability and overexploitation in Fisheries. The discussion begins with a brief description of the fishery, and continues on to examine the bio-ecological, economic, social, and institutional factors of unsustainability. The discussion of each factor provides a historical perspective, and then concludes with a description of the positive actions that show that the administration has fully comprehended the aims of management that promote fisheries sustainability. This is followed by a description of the obstacles that must be overcome in order to continue advancing. The document concludes by identifying the main factors associated with unsustainability and a list of the actions that could contribute to improving the sustainability of the small pelagic fisheries in Chile.

1. DESCRIPTION OF THE FISHERY

In Chile, there are two main fisheries units of small pelagic fish, one which is located in the north zone of the country (18° 21' –24° 00' S.L.) and another which is located in the centre-south zone (32ª 00′-43° 30' L.S.) (Figure 1). The northern unit shares the anchovy and sardine stock with the fishery of southern Peru.

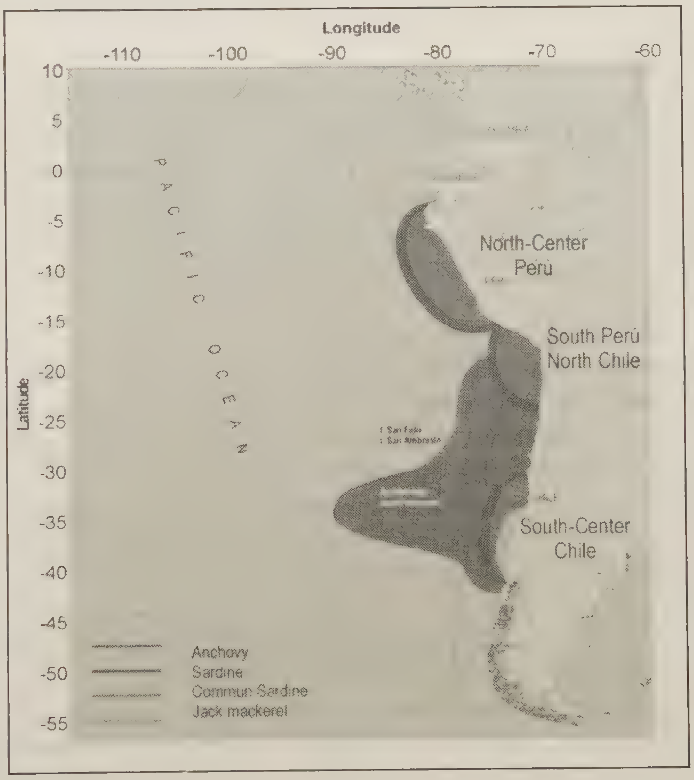

Figure 1. Localization of the Chilean fishery of small pelagic fish.

The fishery is located in the Humboldt Current upwelling system on the eastern border of the South Pacific, which is similar to the current systems of California, Benguela and the Canary Islands. The Humboldt Current upwelling system has been described as one of the most productive in the world. The biological production of this system sustains massive pelagic fisheries that represent 17 percent of world landings. The pelagic populations and the associated fisheries are subject to the recurring effects of the El Niño phenomenon and also to low-frequency environmental variations. El Niño modifies the space-time distribution and the abundance of the fish, while the environmental variations produce regime shifts in the pelagic ecosystem and its biological production levels. The regime shifts are correlated with the changes observed in the specific structure of the fish communities and in the pelagic fishery production.

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[29] The views expressed in this paper are solely those of the author, Alejandro Zuleta V., Centro de Estudios Pesqueros, Universidad Austral de Chile. Valparaíso, Chile alzuleta@entelchile.net.

The industrialized fleet's landings in Chile during 2001 were a little over 4.3 million tonnes of which 73 percent were small pelagic species. The jack mackerel *(Treacherous symmetricus murphyi*) constituted 36 tonnes of the landings of pelagic species. The anchovy *(Engraulis ringens*) constituted 44 percent of pelagic landings, while the remaining 20 percent included the common sardine *(Strangomera bentincki*), mackerel *(Scomber japonicus)* and sardine *(Sardinops sagax*), in descending order. The specific composition of the catches changes according to the fishery unit. In the north zone, the anchovy, the sardine and the mackerel are the main species, while in the center-south zone; the jack mackerel and the common sardine are the main species. Also in this zone, the purse seine fleet tends to catch large quantities of juvenile hoki *(Macruronus magellanicus*), which shows pelagic behaviour, for fishmeal production.

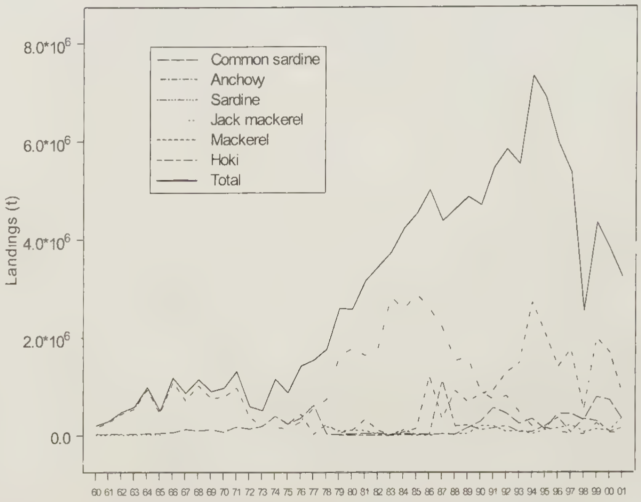

Figure 2. Landings of the pelagic resource in Chile. Period 1960-2002.

In Chile, the pelagic resources are exploited by industrialized and artisanal fleets that use the purse seine for fishing gear. The catch is used mainly to produce fishmeal and fish oil in order to supply the external demand for the materials necessary to make balanced feed for chickens and pigs and the internal demand of the salmon-farming industry. In recent years, the production and export of frozen jack mackerel has increased and an increase of internal demand is expected.

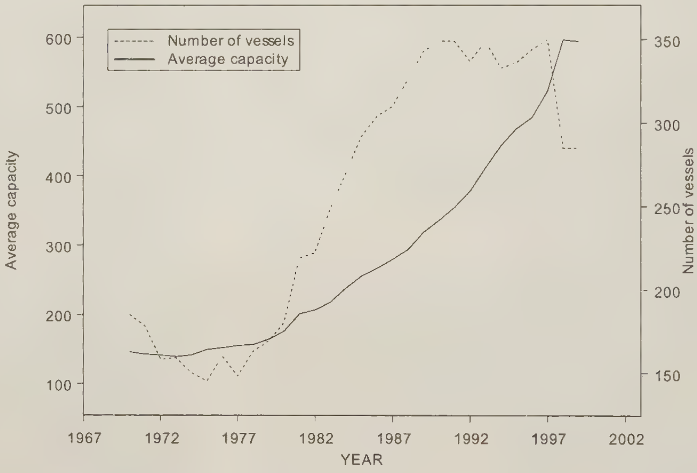

Figure 3. Number and mean hold capacity of the industrial of the purse seine vessels in the Chilean fishery of small pelagic fishes. Period 1970-1999.

The fishmeal and fish oil industry constituted 30 percent (US$260 million) of the value of the exports of fishers during 2001. The proportion of the value generated by the export of fishmeal has diminished with respect to the total and the unitary value of the exported tonnes has augmented. Currently, this product is sold in 52 external markets, of which the most important are Japan, China, and Taiwan.

Between 1960 and 2002, the pelagic fishery showed three successive peaks of production, which were associated with the dominance in the catch of the anchovy, sardine, and jack mackerel (Figure 2). The first two peaks are related to the alternation between the anchovy and the sardine in the catches of the environmental variations produce regime shifts in the pelagic ecosystem and its biological production levels. The regime shifts are correlated changes observed in the specific structure of the fish communities and in the pelagic fishery production.

During most of the history of the pelagic fishery in Chile the industrialized fleet has been the main contributor to the catches. However, during the past decade, artisan fishing of the common sardine and anchovy has grown remarkably, reaching almost 18 percent of total landings. This is the response to the stimulus provided by the government's decision to grant exclusive fishing rights to the artisan sector within a zone that is five nautical miles wide. The effective control of the operations of the industrialized fleet by means of satellite positioning devices has also contributed to the success of this measure.

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2. IS FISHERY MANAGEMENT SUCCESSFULLY ACHIEVING THE FOUR COMPONENTS OF SUSTAINABILITY?

2.1 Bio-ecological component of sustainability

2.1.1 Protection, conservation, and restoration of the stocks

Despite the fact that the State mentioned the objectives of conservation and protection of fisheries resources in the legal body of fisheries administration (DL[30] No. 34 of 1931), which was in force when the small pelagic fishery was first developed, the government prioritized the promotion of the emerging industry and the administrators applied protective measures that they believed to be reasonable and easy to apply (reproductive bans and size restrictions). The administration did not comprehend the importance of initiating conservation actions. This attitude prevailed in fisheries administration despite the crises of the anchovy species as a consequence of the El Niño phenomenon of 1965, 1968 and 1972-1973.

The administration justified these proceedings with their minimal knowledge of the biology and productive capacity of the resources, the competition for the anchovy stock shared with southern Peru and the deep-rooted perception in the public and private fishing sector that resources like the anchovy were unmanageable. This perception was due to the highly variable and sensitive behaviour that the anchovy showed in situations of uncertain environmental disturbances, and to the evidence supplied by other similar fisheries in the world that had experienced similar fluctuations in abundance (Californian sardine, Benguela sardine, North Atlantic herring, etc.).

The level of concern about conservation demonstrated by the administration changed significantly during the peak of exploitation of the Spanish sardine, which followed the collapse of the anchovy in 1973. In 1982, the technical division of the Fisheries Under-Secretariat assessed the stock of the Spanish sardine, taking advantage of the data series available at the time (Serra and Zuleta, 1983 and Zuleta and Serra, 1983). These studies permitted a greater comprehension of the effects of fishing, determining that it, together with recruitment, was another factor that explained the changes in abundance that occurred in the 1980s. In particular the studies determined that it was the immediate cause of the dramatic reductions in spawning stock that occurred in 1982 when El Niño 1982-1983 pushed the resource toward the coast.

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[30] DL is the acronym for "Decreto Ley," which is an executive ordinance dictated without any participation of the legislative body.

The authorities became concerned about these occurrences and decided to apply a TAC of 1.3 million tonnes for the first time in 1983, based on an estimation of the abundance by means of VPA and the constant fishing mortality strategy $F_{0.1}$. The industry resisted this measure which, not surprisingly, due to the excessive size of the fleet, shortened the fishing season. Given that the economy was in recession at the time, this decision led to strong social and economic pressure on the authorities, which eventually gave in to this pressure first by adding a supplement to the quota and finally by revoking it.

International experts later reinforced the importance of the effects of fishing and the need to implement conservation regulations, introducing the concepts necessary for the implementation of such regulations. Murphy (Doucet and Murphy, 1986) introduced the concept of minimum spawning stock and suggested as a conservation objective for the sardine the maintenance of a spawning stock of no less than 2/3 of the virginal spawning biomass. The objectives of this recommendation were to maintain an adequate average recruitment level, to exercise sufficient pressure over other competitive species, and to maintain a greater number of age groups available in the reproductive stock in order to allow it to protect itself from unexpected recruitment problems. At this time, Burd (1987) drew attention to the disappearance of the most fecund ages of the sardine stock and interpreted the diminishment of the first maturity age (one year) as a sign of the stress in the population due to the high levels of mortality from fishing. In the face of the scepticism of the administration, the industry and many national scientists, Deriso (1988) later demonstrated that it was possible to design effective catch policies for the sardine that would allow the objective of conservation to be achieved, despite the great uncertainty surrounding the relationship between stock and recruitment.

The belief that conservation was possible became stronger in later years, as was evident in the work of the technical departments of the Under-Secretariat and the research institute, and in the new legislation which recognized more explicitly a broader range of instruments and conditions for achieving conservation. However, at present the administration still has not incorporated the restoration of depressed stocks as a key objective, except the incorporation in the Fisheries Law of the need to apply different administrative regimes of full exploitation or recovery for incipient fisheries.

2.1.1.1 Positive Actions

The positive actions were:

- The attempt, although a failed one, of the Fisheries Under-Secretariat to apply a catch quota to the sardine fishery in 1982, which demonstrated a willingness to control the exploitation rate and implement conservation measures for the first time in the history of small pelagic fisheries.
- A series of regulations in which the authorities manifested their explicit intention to protect the pelagic resources using the elements permitted by the Fisheries Law, fundamentally directed at recruitment and reproduction (reproductive and recruitment bans for the anchovy as of 1987, minimum size of the sardine and jack mackerel, a protected area within the first mile offshore).
- The reaction, although late, of determining a management procedure for the crisis of the jack mackerel fishery, based on catch quotas and constant monitoring of the fishery. This marks a change in the attitude of the industry with respect to the acceptance of conservation measures that regulate the exploitation rate of the pelagic fishery resources in general.

2.1.1.2 Obstacles

The obstacles were:

- the regulations were based on economic factors rather than conservation principles; the catch quotas arrived late and as a way of mitigating or complementing economic or social decisions;
- the regulations for protecting the spawning stock and the recruitment fulfilled the goal of "soothing the conscience" more than the goal of controlling the fishing mortality since the fleet was able to increase the effort notoriously outside of the close season in order to compensate for the lower catches of these periods;
- the difficulties with enforcing the measures that would have the highest impact - minimum sizes and the catch quotas;
- the great scepticism that still exists about the effectiveness of the management procedures to achieve the objective of conservation, due to the variability of the resource, the low credibility of the scientific advising, the difficulties with controlling the growth of the effort, and the uncertainty associated with foreseeing the evolution of the resource in the future. This is the reason for the clear reticence of the industry to accept the use of the precautionary approach, which in this case implies a significant restriction on catches that they are not willing to accept.

2.1.2 Prevention of overfishing

SUBPESCA and the former state agencies that fulfilled the same role in the past understood the regulation of fishing mortality as a means of preventing overfishing. However, as was mentioned in the previous section, in all of the efforts of fisheries administration to conserve pelagic resources by regulation the fishing effort or applying catch quotas, the measures arrived too late or failed for a variety of reasons (low sensitivity of the indicators of the state of the resource, uncertainty of natural processes and knowledge processes, high demand of the fishmeal industry, passive scientific advising etc.).

The possibility of preventing overfishing depends on the ability to anticipate the effects of fishing despite an uncertain environment, which, in turn, depends on the comprehension of the system's behaviour, based on immediate experiences and the experiences of other locations. SUBPESCA's lack of proactive behaviour when faced by the overfishing of jack mackerel, after the successive collapses of the anchovy and sardine, shows that the management system is unable to act in a timely and preventive manner. In our opinion the main causes of this problem lie in the poor memory of the key institution (SUBPESCA), in the sacred legislative moorings of the current Fisheries Law, and in the lack of initiative and curiosity in scientific research, which is satisfactory only in that it operates routinely within the administrative process.

2.1.2.1 Positive Actions

None have been identified.

2.1.2.2 Obstacles

There were three major obstacles:

- SUBPESCA's poor memory as an institution, which impedes the development of planned and informed courses of action that reflect a long-term perspective, is related to the scarce endowment of technical personnel with experience and qualifications in fisheries sciences and administration, the high personnel turnover, and the almost nonexistent concern for the documentation of the history of management and the evaluation of the success or failure of the

regulations. The SUBPESCA is definitely a bureaucratic institution with limited ability to learn from past experience, modify the established proceedings, and engage in proactive behaviour.
- According to the Fisheries Law, the requirement that a stock should meet in order to have a CTP applied to prevent overfishing, is that it should have been previously designated a resource in full exploitation. A resource in this condition is defined by the law as one which does not generate surplus production. This definition is clearly deficient: it is tacitly supported by the erroneous idea that fishing in equilibrium is possible in a pelagic system, and even if it were possible in a pelagic system, this definition does not mention the stock size under which overfishing is considered to exist. In addition, despite the fact that this is a technical aspect, it is not an institution such as IFOP or a scientific committee that determines the state of the resource, but rather the National Fishing Council, which is composed of fishing system users. Due to this situation, the people who give opinions on these matters do not have technical competency, and their votes determine decisions that should be determined by scientific evidence.
- Fisheries research is currently understood to be nothing more than a mean of carrying out the previously established management proceedings. The management proceedings based on TAC are without a doubt the most formal and consolidated, and research has been organized based on them. The concept of research is restricted to topics related to norm-making, excluding research on biological, ecological, and economic processes. This focus, which is dominant at present, led IFOP to lose the scientific leadership it had in the past. Scientific advising is carried out only when solicited, and it has been restricted to answering the questions of the administrators, turning into a "service or product" that is given to a "client," who defines not only what to do and why to do it, but also how to do it. This is the reason for the loss of interest of national scientists in the fishing system and the behaviour of the management system, both of which are necessary to foresee the effects of fishing and the environment and to evaluate the merit of the management proceedings.

2.1.3 Multi-specific and ecosystemic considerations

The management approach adopted by SUBPESCA in the pelagic fisheries does not explicitly use any multi-specific or ecosystemic conservation criteria or principles in its regulations. The management has been strictly mono-specific; however, multi-specific considerations have appeared in the lines of argument of processors, fishing researchers and administrators in order to support objectives and certain management actions with respect to the anchovy and the sardine. The processors often postulate that there is a competitive relationship between the two species, and based on that hypothesis, the high fishing pressure on the dominant species is justified in that it would create favourable conditions for the growth of the stock size of the other species.

Researchers and administrators have tended to support the opposing thesis, which states that the oceanographic regime shifts are the main cause of the alternation between the species. Either way, these opinions have not changed the management objectives or the design of the stock assessment measures or models. These aspects continue to be discussed in terms of independent stocks and for each objective species. The only attempt that alludes explicitly to objectives and regulations of catch rates is Murphy's recommendation in the report of Doucet and Murphy (*op. cit.*) mentioned in the previous section, in which he highlights the sardine's predation of anchovy eggs and the convenience of diminishing the exploitation of this species in order to achieve a more balanced coexistence of the two populations, as long as the environmental conditions are favourable for the sardine.

At present, the concern for these aspects has almost disappeared from the fishing sector; it only appears in a very sporadic and tangential way in academically-oriented studies on large-scale oceanographic processes. Well-founded studies of the physical and biological variability of the Chile-Peru current system conclude that the marine ecosystems located in current systems of the eastern border are ecotones that are dominated to a great extent by physical processes in which the biological interactions, such as competition and predation, are secondary as regulatory mechanisms of abundance, due to the disruptive effect of changing environmental conditions that do not give the mechanisms the opportunity to act (Bernal, *et al.* 1983). This vision, which has replaced the extreme hypotheses mentioned previously, backs up the Murphy's arguments.

The new Fisheries Law bill includes the ecosystem approach among its principles, adhering in this way to the new approaches promoted by the international community through the FAO. Its perspectives are more encouraging than the multi-specific approach given that there are evident interactions in the ecosystem that cannot be evaded, such as the importance of small pelagic fish as a key link in the food chain of marine mammals, marine birds and the coastal species exploited by the artisan fishers. Hence the participation of Chile in the Great Marine Ecosystems project.

2.1.3.1 Positive Actions

Positive actions are:

- the incorporation of the ecosystem approach in the bill of the new Fisheries Law;
- the participation of Chile, through IFOP, in the preparation of an integral regional project on the Great Marine Ecosystems.

2.1.3.2 Obstacles

Obstacles are:

- The present reluctance of administrators, entrepreneurs, and those involved in stock assessment to incorporate an approach that does not have the quantitative detail and precision necessary to make it a better alternative to the design of regulation measures based on the mono-specific approach (control of the effort, size regulations, close season, etc.).

2.2 Economic Component of sustainability

2.2.1 Fishing and Processing Capacity

The small pelagic fishery in Chile has been developed since 1957, in response to the high unemployment and social conflicts that resulted from the major crisis of the Chilean nitrate mining industry in the northern zone when natural nitrate was replaced by synthetic nitrate in the international markets. In the port of Iquique, the city hardest hit by poverty, the recent development process of the Peruvian fishing industry was emulated. This development was later extended to other neighbouring cities (Arica and Antofagasta).

Three factors made this development economically possible. First, cheap labour was available because of the Chilean nitrate mining crisis and the migration of unskilled workers from the central zone of the country (Santiago and Valparaíso). Second, the great abundance and coastal concentration of the anchovy resource allowed it to be caught at no more than ten miles of distance from the coast and with yield per haul that justified large-scale exploitation. The third factor was the state subsidy for investment in industrialized fleets and plants, which was supplied by the Corporation for the Promotion of Production (Corporación de Fomento de la Producción, CORFO), a government institution created at the beginning of the 1950s in order to guide and support the industrialization process of the country. In 1958 CORFO allocated US$16 million for easy credit to finance the installation of fishmeal processing plants and the acquisition of vessels. Two years later, the DL No. 266, which was in force until 1976, granted tax advantages that reduced by 90 percent the tax on profits, established duty exemptions for the importation and installation of industrial machinery for a period of 10 years, subject to the condition of reinvesting 75 percent of the profits in the sector.

The actions to promote production provoked the rapid and explosive growth of the fishing effort and the industrial capacity, which was characterized by highly speculative investments and unlimited trust in the potential of fishing resources. The growth peaked in 1965, at which time the industrial complex possessed 37 plants, with a processing capacity of 3.6 million tonnes of raw material per year and a fleet of 251 vessels. The excessiveness of the investment became evident that same year, when the 1965 El Niño phenomenon caused a substantial reduction in the catch, from 1 million to 0.4 million tonnes, causing the paralysis and closing of numerous companies. The response to this first crisis was the suspension of the loans for the installation of new plants and the rejection of new permits for the initiation of activities of fishmeal companies. At the same time, the State offered advantages for the merging and modernization of the companies and financial support to mitigate the social impact of the measures (Zuleta, 1990).

A new crisis occurred in 1972 as a result of El Niño 1972-1973. This oceanic anomaly, more intense than that of 1965, drastically reduced the sizes of the stocks and the catches for two consecutive years, causing the anchovy fishery to collapse. In this period the industry became even more concentrated and the socialist government of the time intervened in the crisis by purchasing companies, and assigning CORFO the task of administrating them. All of these actions were carried out within the framework of a general policy intended to create a social area of the economy constituted by public and private companies that were considered to be strategic. This situation was reverted during the military government that followed the military coup in 1973, which re-privatized the industry, reconstituted the large companies that had dominated production in the past, consolidated the process of economic concentration that had been occurring, and created the conditions for a new growth based on a market economy, the stimulation of exports, the exploitation of comparative advantages, and the principle of the subsidizing role of the State in those areas in which the market was not capable of assigning the productive factors correctly (Caviedes, 1981 y Duhart *et al*, 1987).

In the northern zone of the country, a second phase of investment associated with the development of the sardine fishery, which replaced the anchovy in the catch, occurred in the 1980s. Given its distribution further offshore, the fleet began to incorporate vessels of greater tonnage and more efficient fishing technology that increased the fishing effort, and the plants improved their processing technology in order to produce fishmeal of higher quality. This period was marked by the spectacular growth of a series of indicators such as the landings, the value of the exports, and the GNP, among others. In the decade of the 1980s, the country reached first place as a fishmeal producer; however, the instability of this development was demonstrated once again when, after the phenomenon El Niño 1982-83, in its most intense manifestation up to the present, the sardine catch started to diminish progressively and the fishery collapsed a second time.

After these two successive industry crises, the fishing authority was not sufficiently interested and willing to intervene in the processes that caused the over-investment, which explains its poor receptivity for the results of the consultants Doucet and Murphy (1986), which made evident the process of over-investment and proposed instruments to control it and improve the economic efficiency of the industry.

After the crisis in the pelagic fishery in the northern zone, a third phase of investment was initiated, based on the exploitation of jack mackerel, this time in the center-south zone of Chile, the region in which this resource was most abundant. Its distribution, which was even broader and further offshore than that of the sardine, required a fleet with vessels of a large hold capacity (up to 1500 m^3) and with a system for preserving the catch in order to achieve greater autonomy, in the same way that the requirements of the market led the industry to invest in new, high-technology processing plants for the production of special fishmeals to supply the emerging national salmon-farming industry.

During the decade of the 1990s, despite the change to a democratic government, development continued to be considered a synonym for economic growth. Toward the end of this decade, the situation began to change, economic studies warned about the potential loss of the earnings of the jack mackerel fishery, there was a greater comprehension of the problems of economic inefficiency associated with the over-investment processes, but there still was no agreement with respect to the most efficient administrative instruments to control it. In 1986, the administration passed the DL

No. 436 with the goal of freezing the purse seine fleet in regions I, II and VIII, but this measure proved to be late and insufficient to limit the access effectively, given that its on-going application always left some regions open. In the year 2000 the passage of the Fishing Law No. 17913, which introduced individual quotas per ship owner, was a more decided step to solve the problem of the over-investment. With this law, the fishing industry has initiated a readjustment process which has meant the elimination of the "Olympic race" for the catch quota, a reduction by 70 percent of the size of the fleet, the merging of companies, and the continuation of the economic concentration.

2.2.1.1 Positive Actions

Positive actions were:

- the DL No. 436 of 1986, which limited access to the pelagic fishery, impeding the entrance of new vessels and the installation of processing plants;
- the authority's receptiveness to the needs of the industrialized sector in terms of promoting management plans that prioritize the efficiency and economic stability of the industry, in contrast to the prevailing historic tendency to prioritize growth over efficiency;
- the Fisheries Law No. 17913 of the year 2000, which introduces individual quotas, achieving for the first time a reduction in fishing and processing capacity. The Congress recently extended this law so that it would be in force for 10 more years.

2.2.1.2 Obstacles

Obstacles are as follows.

- The Fisheries Under-Secretariat still has not achieved the effective closing of the fishery. Opposing measures co-exist: some seek to limit the access to the fishery (DL No. 436 of 1986, which froze the purse seine fleet in Regions I, II y VIII), while others allow the entrance of new vessels and the installation of fishmeal processing plants in regions that are still open (Fisheries Law No. 19245 of 1993).
- Despite the increasingly generalized acceptance of the convenience of a system for distributing the catch by means of individual quotas, there are difficulties with consolidating such a system. Some of these difficulties are associated with collective allocations that have not received the necessary attention. The distribution among artisanal and industrialized fishermen is part of the problem, but within each of these sectors there is heterogeneity among the sizes of the economic actors and destination markets that has not been considered and has caused the legislative efforts in this area to fail. This has impeded progress in guaranteeing that that the rights be transferable and temporary, and also in establishing the mechanisms that would ensure the entrance of the most efficient and innovative actors.
- The mechanisms that regulate the rights of individual or collective use have been introduced with little publicity, consultation, and participation of the actors involved in the fishing industry and other interest groups. This has generated significant resistance among those who feel that the mechanisms are detrimental to their interests, which impedes reaching a consensus and obtaining the support of the communities at the local level.

2.2.2 Commerce

As an exporting country, Chile follows the rules of the World Trade Organization (WTO) and does not grant the fishing sector any type of subsidy, that is, external support (normally from the State) of any type given in any phase of the productive process of an industry, which allows it to diminish its costs or increase its incomes artificially. In response to the export model implemented by the Chilean government in 1974, the Corporation of Fish Exporters (CORPESCA) was created, with the objective of monitoring favourable commercial opportunities in the international fishmeal markets, safeguarding the transparency of the markets and the quality of the products, respecting the requirements of the WTO and protecting its members from non-tariff barriers.

Until the determination of the maximum catch limit per fleet owner, the authorities did not show much concern for illegal or poorly reported fishing. No estimation of illegal or poorly reported fishing is available, but it was probably significant considering the multi-specific nature of the catches and the deficient means of controlling the close seasons, the proportion of fish under the minimum legal size limit, and the access to restricted fishing zones. The State eventually became motivated to control illegal fishing because the value of the quotas would decrease and the system would lose credibility if it was not controlled.

In order to impede illegal fishing and minimize under-reporting, the Law endowed SERNAPESCA with a catch certification system run by private companies which registered all of the landings of the purse seine vessels. As a nation, Chile seeks to maintain the access to international markets by fulfilling the new requirements of international entities such as CITES.

2.2.2.1 Positive Actions

Positive actions were:

- the creation of CORPESCA
- the creation of the catch certification system under the supervision of SERNAPESCA

2.2.2.2 Obstacles

No obstacles have been identified.

2.3 Social component of sustainability

2.3.1 Use

During the first phase of the development of the small pelagic fisheries in the northern zone of Chile when the main resource was the anchovy and the stock was abundant, there was never a real incentive to use the catch for anything but fishmeal and fish oil. Only two percent of the catch of this species was canned and a minimum was used for fresh or pickled products. During this period the importance of using this resource for products for human consumption was recognized, given that the lack of protein in the alimentation of the Chilean population was recognized, but it was not proposed as an alternative to fishmeal and fish oil. The government at the time promoted the diversification of the use of the above-mentioned products and others that appeared in the international markets, among which were the protein-concentrates, salted anchovy for canning, edible oils and traditional canned products.

Between 1970 and 1973, this idea turned into concrete actions for a short time when the government of the time created a State organization called the Fishing Sector Committee, whose objective was the development of the fishing industry, the administration of the fishing companies of the social area, and to guarantee the supply of fish for the consumption of the population by means of the Society of Fish Terminals (SOTEPES). Likewise, the development of new alternatives of non-traditional products was explored, for example a project that involved the production of concentrated proteins that could be incorporated in different foods of the diet, such as bread, milk, and others, which launched the Industrial Protein Committee (CPI). However, the pelagic species, compared to the demersal species, were never an adequate prime material for the production of protein concentrates due to their high fat content.

After the crisis of 1972-1973, when the anchovy stock collapsed, the perception of the use changed fundamentally. Sardines and jack mackerel, which had previously been caught only in small volumes by fleets specialized in supplying the canning industry, emerged as alternative species. Only on a few occasions had they been used for the fishmeal industry. In 1985 Gil (op cit) pointed out that "This supposedly rational way of using the pelagic resources hides a dramatic reality unknown by the majority of the population and possibly by the authorities, which is the fact that 80 percent of the prime materials are species that possess high nutritional value, which…should be used completely for human consumption…" The same author stated that the most deplorable aspect of this situation was that the high-quality protein, in the form of chicken and pork, was consumed in Europe and the United States, while the majority of the Chilean population suffered from chronic malnutrition.

In times of scarcity, the industry had a similar perspective. It believed that the development of the fishing industry could not be based on a substantial increase in fishing the traditional species without destroying the resources, and for that reason, it was "absolutely convenient to optimize the use of the prime material that is processed in such a way that higher and higher percentages are gradually used for the preparation of products for human consumption, the demand of the market permitting..." (Izquierdo and Iturriaga, 1985), hoping to increase in this way the national consumption per capita of species of high protein value and low cost. The use of the pelagic resources changed radically in later years when the sardine and jack mackerel species showed an availability that heightened production to an unprecedented level. These species, which had never before been considered for uses that were not associated with human consumption, were used expressly for the production of fishmeal and fish oil. At present the fisheries administration still maintains the priority of optimization, but because it operates within the framework of an export-based and free market economy, it leaves to private companies the decisions about the most convenient commercial option.

2.3.1.1 Positive Actions

Positive actions were:

- the norms established by the Fisheries Under-Secretariat allow jack mackerel to be caught for human consumption when fishing for the fishmeal processing industry has been banned;
- the establishment of a coastal reserve zone for artisanal fishing, which provides a higher guarantee of the supply of fresh fish.

2.3.1.2 Obstacles

Obstacles are:

- the DL No. 316 of the Ministry of the Economy, Promotion and Reconstruction, which was promulgated on 1 October 1985, establishes that only the anchovy, Spanish sardine, common sardine, jack mackerel, jack mackerel, hoki, pollock, krill and waste from fish and crustacean processing plants may be used as prime material for making fishmeal;
- the lack of auction markets, which would organize and make the first-hand market efficient for the artisanal sector, stimulate added value and impede the intermediaries from monopolizing the supply;
- percent) may be auctioned to new investors, including those who could be interested in developing productive activities for human consumption (barrier to innovation);
- the cultural problem of the people, related to consumption of fish, which makes it a second alternative to other animal proteins (such as red meat).

2.3.2 Working Conditions

In the beginning of the fishery, the workforce engaged in fishing labour (owners, crew, and motor-operators) had a low level of technical skills and was composed of workers who migrated after the close of the Chilean nitrate mining industry and from the marginalized neighbourhoods of the large cities such as Santiago. These workers began to engage in an inherently difficult, toxic, dangerous, and unhealthy, with high mortality and accident rates that exposed them to a premature physical aging that prevented them from maintaining an active work life up to the legal retirement age (65 years). The labour conditions under which the fishing industry was developed were very precarious and unbearable for the above reasons and the continuous family separation and distancing from their homes, and a workday without a schedule.

In response to this situation, between 1965 and 1968, the first syndicates were organized and the demands and social movements for better work conditions began, culminating in the establishment by the authorities of Regulation 214, which regulates the work conditions aboard the ships. This regulation stipulated an eight-hour workday with a maximum of two hours overtime, alimentation, the hygiene conditions, and the rights and obligations of the captains and crew.

Later, as the fishery developed, especially in the periods of greater abundance, the regulation converted into a factor that diminished the crew's hopes of a higher income given that they could not work longer than the established workday and take advantage of the incentives offered by the companies for a larger catch. There were direct negotiations between the workers and the companies in order to evade the regulation, which turned into a coercive instrument when the agreement was not fulfilled. The base salary of the fisher was very low, and a majority of their income came from the incentives associated with the volume of the catch. The captains established a goal for the catch, in terms of volume and disregarding quality, and the crew's jobs and benefits depended on reaching these goals, and they received a payment proportional to the mentioned volume.

At present, with the introduction of the individual catch quotas, the number of vessels in operation has decreased, there is less competition, and the quality of the catch is a priority over the quantity. As a result of the adjustment of the fleet, there are more captains and crew available, the salaries have become fixed and the incentives have disappeared, and the contracts are temporary. All of this leads to less stable and lower-paid jobs than in the past.

2.3.2.1 Positive Actions

Positive actions were:

- recognition by the authorities of the need to regulate labour onboard, which soon materialized in the above-mentioned Regulation;
- the validity of the Labour Code, which among other regulations, establishes an obligatory rest period of 10 hours per day.

2.3.2.2 Obstacles

Obstacles are as follows.

- The weakness of the crews' union organizations. The syndicates are no longer protagonists as they were in the past, and the role that they played in the hiring process and the determination of the working conditions has been transferred to the captains, which choose the crew directly without any intervention of the syndicates.
- despite the fact that sustainable development is conceived as a balance between the objectives of efficiency, conservation and equity, the objective of equity carries little weight. The predominance of the objectives of economic efficiency over the distributive objectives has caused the government to neglect the topics associated with the quality of life and training of fishers.

2.3.3 Diversification

The State is especially interested in financing projects that involve innovation and the development of marine cultivation in general. To apply for these grants, research groups must form associations with established companies that have committed to apply the results in the production phase, which could even imply the creation of new companies if necessary. Therefore, there are favourable conditions for initiating projects that involve the cultivation of pelagic species, however, these pelagic resources, with few exceptions, have not been of interest for diversifying production by means of cultivation. Even given the dramatic drops in the stocks, these resources have not been sufficiently scarce in order to lead to their cultivation as an alternative to fishing activities. It does not seem reasonable to reproduce artificially in a controlled environment the natural conditions present in abundance in the upwelling systems given that high production costs make companies unprofitable.

At present, the only successful project is the cultivation of anchovy larva in order to obtain a valuable salted dried product for the Japanese market.

2.3.3.1 Positive Actions

A positive action is the availability of funds for projects of innovation and development, for the possible creation of companies.

2.3.3.2 Obstacles

An obstacle is the lack of high-level ecologic and genetic research in order to sustain the development of cultivation technologies in controlled environments and the development of projects of ecosystem intervention with the goal of recuperating or increasing wild stocks.

2.3.4 Technical Support

Despite the high level of development the Chilean fishing industry has reached, the concept of giving technical support to under-developed countries has not been internalized. There are government initiatives to give technical support to Central American and Caribbean countries, and as a result small fishing missions have been carried out, but technical support is not an active and permanent concern at this time.

2.3.4.1 Positive Actions

A positive action was the creation of the Government Agency for International Cooperation (Agencia Gubernamental para la Cooperación Internacional, AGCI), to promote technical support to other countries of the region.

2.3.4.2 Obstacles

An obstacle is the lack of economic resources to finance technical support projects.

2.4 Institutional Factors of Sustainability

2.4.1 Scientific Information

The importance of scientific information for the management of national fisheries, and in particular the small pelagic species, was recognized early on. The founding in 1964 of the main national fishing research institution, the Institute for the Promotion of Fishing (Instituto de Fomento Pesquero, IFOP), was part of the same set of development policies and incentives, applied by the government of that period, that gave impetus to the fishmeal processing industry in the northern zone of the country.

IFOP was created with the collaboration of the UNDP and the FAO with the objective of carrying out research on marine resources, fishing oceanography, improvement of fishing methods and processing, fisheries economy and sales of fish products, among others.

After a decade of research, there were advances in knowledge of the distribution, abundance, and parameters of the life cycle of the main economically important species, but there was less progress in environmental knowledge and almost none in the stock assessment and the design of administrative measures. The use of stock assessment is more recent, it was initiated at the beginning of the 1980s with a program of stock assessment of the main pelagic resources based on catch at age method (VPA) and acoustic estimations of the size of the stock. These were chosen due to the limitations of the methods based on catch and effort data, inherent to the hyperstable behaviour of the Catch Per Unit Effort (CPUE). In later years, the Eggs Production Method was incorporated, the VPA was replaced by ADAPT and more recently by statistical catch at age methods similar to CAGEAN.

After the first economic studies on the development of the industry and the markets, this research has not progressed beyond a very preliminary descriptive and analytic phase. Studies of bioeconomic processes are still an incipient area of Chile's national fishery research, among them are some studies carried out on small pelagic fisheries. The evaluation of cost-effectiveness, efficiency, and the socioeconomic effects of the administrative measures are still unexplored research topics. The same could be said of the evaluation of performance and the usefulness of the measures adopted.

2.4.1.1 Positive actions

Positive actions were:

- the creation of IFOP and the main areas of research that formed the basis of the biological, environmental, and economic knowledge of these fisheries;
- the creation of the Fishing Research Fund (Fondo de Investigación Pesquera, FIP), financed with the fishing licenses, which significantly increased the research budget in terms of relevance for fisheries management;
- the incorporation of a fishing and oceanography research ship equipped to carry out direct assessments using the hydroacoustic method and the eggs production method;
- the organization of advanced courses on stock assessment and economy seminars with the support of FAO/DANIDA;
- the promotion and development of programs to monitor the commercial fishery and the process of stock evaluation within the framework of a management proceeding based on the annual estimation of the Total Allowable Catch per resource.

2.4.1.2 Obstacles

Obstacles were:

- the policy of self-funding of IFOP, which, in order to maintain the institutional budget, dedicated a considerable part of its research time to the production and management of projects, with consequences for the quality, relevance, and continuation of the research;
- the distortion of the mechanism for assigning FIP projects, which favoured IFOP, monopolizing a large portion of the funding, which was conceived as a competitive fund open to Chile's scientific community;
- the lack of incentives and means for publicizing the results of the research, which causes a majority of the results to reach only the level of "gray literature," but not to meet the standards of a publication with an editorial committee and peer revision;
- the limited planning of the research. The local demand for research is determined by means of the Zone Councils in the regions where the fisheries are established, and it is then channelled through the councils to the central administration, Fisheries Under-Secretariat, and the National Fishing Council;
- the lack of institutional policies that stimulate the research of biological and ecological processes in terms of the population and the ecosystem.

2.4.2 Precautionary Approach

Chile has accepted the general principles and norms of the precautionary approach, however, there is still much to do in order to achieve the practical and operational value of these concepts within the framework of the law, the fisheries legislation and the sectoral policies of the country.

Chile has ratified the conventional nucleus of the precautionary approach (Convention on the Law of the Sea and the Convention on Biological Diversity), the main instruments linked to the application of the precautionary approach (Convention on the Conservation of Antarctic Marine Living Resources on the High Seas of the South Pacific and the Convention for the Prohibition of Fishing with Long Driftnets Nets in the South Pacific) and other instruments that share the basic conceptual framework of the precautionary approach (Río Declaration on Environment and Development and Agenda 21). In addition, Chile has been part of the Core Group of participating countries in the negotiations of the New York UN Agreement on Fishing in the High Seas, which recommends that the States apply the precautionary approach to the administration and exploitation of the fisheries (Hernández, 1998).

All things considered, the incorporation of the precautionary approach in the small pelagic fisheries and the Chilean fisheries in general has been marked by the transzonal nature (anchovy and sardine stock, shared with Peru) and highly migratory behaviour (jack mackerel) of some of its resources, and to a lesser extent, by the concepts of sustainable development and the preventive and timely action that the management of these resources within the EEZ demands.

2.4.2.1 Positive Actions

Positive actions were as follows:

- The ratification and signing of all of the international agreements mentioned in the previous paragraph, accepting the principles and norms of the precautionary approach;
- The Chilean fisheries legislation implicitly recognized the validity of the precautionary approach when, in the final clause of the first article of the General Fisheries and Aquaculture Law, it established that its norms should be understood "as respecting the international agreements signed by the Republic";
- The *de facto* application, without the backing of the Law, of minimum spawning stock thresholds and acceptable risk levels in the determination of exploitation strategies and the calculation of the TAC, has opened up the possibility of using precautionary criteria and concepts in the framework of scientific advising of fisheries management. Stock assessment has become more and more sophisticated, taking into account diverse sources of uncertainty (in the estimation of the size of the stock, the recruitment, etc.) and incorporating simulation stochastic methods to quantify the probability or risk of overfishing.

2.4.2.2 Obstacles

Obstacles are as follows.

- The asymmetry of the legal principle upon which the ability to "restrict the right to fish" is based often turns into an obstacle for exercising the "right to restrict fishing". For Chilean law, the precautionary approach is a restriction to "open fishing," which was established as an economic activity in the Political Constitution of 1980. When applying the Constitution, the State can limit the exercising of this right when the restrictions are specific and determined by the law, with the additional requirement that fishing can only be regulated in abnormal or exceptional situations (Soto, 1996).
- The lack in fisheries legislation of a normative definition based on principles and concepts of the precautionary approach, which would allow the risk of over-exploitation to be confronted

- in the context of a decision-making process that is not contentious, in which any measures adopted that utilize the precautionary approach could not be questioned for lack of a legal basis.
- The precautionary approach is a new element in fisheries management and the institutions that could make the most significant contribution toward its application (SUBPESCA and IFOP) do not appear to understand either its scope or the ways in which it may be implemented. As mentioned earlier, the methodological aspects were understood before the principles, imitating the technical standards of international commissions.
- The superficiality with which the administration and scientific consultants have incorporated these principles, particularly the threshold of tolerable risk, the biological points of reference, the environmental uncertainty and the concept of damage; without a participatory management process that could legitimate their application scientifically and administratively, has contributed to the transformation of the approach into a new construct, apparently more "objective," which has had many negative consequences for fisheries management, such as allowing decisions to be discretionary, and causing an apprehensive reaction to uncertainty to take the place of a true precautionary attitude.
- The scarce or nonexistent attention that has been granted to the management plans, instituted in the Fisheries and Aquaculture Law, as an instrument to implement the precautionary approach. The management plans, which are adopted by means of a previous consultation process with the users at the level of the Zone Councils, are not only a means of adopting a consensual strategy for the conservation and development of a fishery, but also a means of extending the reach of the precautionary approach to other areas of the process of fisheries management, such as research, design, enforcement, and the follow-up on the performance of regulatory measures.

2.4.3 Monitoring, control and surveillance

The monitoring of the pelagic fisheries was initiated with the creation of the Fishing Promotion Institute (IFOP). The programs of biological sampling and catch and effort surveys were focused on the dominant species in the catch (anchovy, sardine, and jack mackerel). Statistical sampling plans of the anchovy fishery which was designed early on served later as the model for the other fisheries (Tomlinson). Coastal sampling laboratories were implemented with CORFO funding in the main unloading ports (Arica, Iquique and Talcahuano). At present, CORFO's support has been suspended, but the monitoring continues under the supervision of IFOP and the funding is now the responsibility of the Fisheries Under-Secretariat.

The supervision of the landings has been a task assigned to the National Fisheries Service (SERNAPESCA), as the authority responsible for the publication of national fisheries statistics in the Statistical Yearbook. This government institution also controls the catch quotas and enforces the regulation norms (bans, minimum sizes, etc.). In recent years, with the generalization of the global quota system and its allocation by means of individual quotas, private companies have taken on the task of certifying the catch, reinforcing the existing system.

Surveillance has been in the hands of the Chilean Navy, which has assumed this task within the framework of its activities. Recently the surveillance activities have been strengthened by the incorporation of a satellite positioning device in the vessels of the fleet and the establishment of an EEZ satellite surveillance system of the Maritime Territory Department of the Navy (Dirección de Territorio Marítimo de la Armada DIRECTEMAR), which, used in coordination with SERNAPESCA, has permitted effective enforcement of the five-mile maritime zone reserved for the artisan fishermen.

2.4.3.1 Positive Actions

Positive actions are:

- the monitoring program of the small pelagic fisheries as a permanent activity that supports fisheries administration;
- the system for controlling and certifying catch which SERNAPESCA maintains and coordinates in its enforcement role;
- the surveillance of the behaviour of the industrial pelagic fleet via the satellite surveillance system, carried out by DIRECTEMAR.

2.4.3.2 Obstacles

Obstacles are as follows.

- The lack of an adequate quality control of the data. The minimal feedback between those who are in charge of gathering the data and the users of the data has made difficult the development of new and better protocols for recording and controlling the quality of the data and a cost-benefit analysis of the monitoring activities.
- The monitoring system is not organized as a reference system for fisheries management. It was created basically as an information system with emphasis on the proceedings associated with recording, storing and managing the data, but with very little emphasis on its usefulness for characterizing the state of the fishery based on indicators and points of reference.
- The lack of a database with effective data quality control proceedings and practices which are intended to preserve the integrity and continuation of the historical time series and the statistical designs.

2.4.4 Decision-making process

The government institutions associated with the fishing sector have developed as a result of the importance that fishing and aquaculture have acquired in the national economy. The three basic roles of public administration directly related to the management and development of fishing activity are promotion, regulation and enforcement. The first has been an on-going, permanent role of CORFO, while the other two, which are related to fisheries administration, were formerly carried out by the Agriculture and Livestock Service of the Ministry of Agriculture, which was not focused on or specialized in fisheries management, until the restructuring of the public fishing sector in 1976.

The reorganization of the government institutions associated with fisheries in 1976 led to the creation of the current institutions and the assignment of the tasks of fisheries administration to different institutions, two of which were created within the Ministry of Economy, Promotion and Reconstruction: the Fisheries Under-Secretariat (Subsecretaría de Pesca, SUBPESCA) would handle regulation and management, while the National Fisheries Service (Servicio Nacional de Pesca, SERNAPESCA) would handle enforcement and control. Fisheries research and scientific advising for the fisheries management, which are linked to the other roles, would continue in the hands of the Institute for Fisheries Promotion (Instituto de Fomento Pesquero, IFOP), but would be made more and more dependent upon the Fisheries Under-Secretariat, in order to weaken the role of scientific support in the tasks associated with promotion, which had been important while IFOP was under the management of CORFO. The Zonal Fishing Councils and the National Fishing Council, which were created with the passage of the Fisheries and Aquaculture Law of 1991, completed the institutional structure of fisheries administration.

The fisheries management system has made significant process in the past 20 years. At the beginning of the fishery, it was a primordial system, constituted by the research and administration agencies, without established management proceedings, little formal participation of the users and limited to reactions instead of proactive behaviour when faced by crises; and it evolved toward the current, more complete system, with institutionally differentiated administrative roles, users who are incorporated in the decision-making process by means of the councils and with an organization dedicated primarily to the determination of Total Allowable Catches by means of a formal and integrated management proceeding that involves an annual cycle of evaluation, regulation and control.

2.4.4.1 Positive Actions

Positive actions were as follows.

- The restructuring of the public fishing sector which created the Fisheries Under-Secretariat and the National Fisheries Service not only strengthened the management role, but also contributed to making the process of establishing norms transparent, determining that all of the decrees emitted by the Under-Secretariat to implement the fishing regulations must be guaranteed and backed up by a technical report based on scientific information supplied by the national scientific community, and specifically by IFOP, the institution specialized in this area.
- The creation of the fishing councils (zonal and national), to which representatives of the business sector, labour, artisan fishermen, environmental organizations, and public institutions have access. These councils are involved in consulting and the resolution of issues, and they participate in the previous definition of the applicable regulatory measures. This increased participation has been accompanied by the continuation of the efforts to promote transparency, which were initiated with the restructuring of the sector and which are evident in the publication by the Under-Secretariat of public technical reports and the distribution of these reports to the councils allowing their members to receive the necessary information before participating.
- The fisheries research quotas, a measure defined by the Fisheries Law, which permit the industry and the scientific community to prepare and execute joint research projects that are directly relevant to resource conservation. Under the protection of this special regime, certain fishing activities are exempted from the fishing norms in force under the normal exploitation regime. Unfortunately, this initiative, although its initial orientation was for research, has not had an impact as positive as was hoped due to the use of this instrument on various occasions to authorize increases of the catch beyond the already established limits.

2.4.4.2 Obstacles

Obstacles were as follows.

- The confusion of the levels of discourse in the participatory entities, which does not permit their members to discuss the technical and decision-making topics with sufficient depth and clarity.
- The little transparency and organization of scientific advising and the closed nature of the system, together with the IFOP's excessively dominant role as the consulting body of the Under-Secretariat, to the detriment of other scientific opinions or information. In addition, there is limited access to the basic data necessary in order to conduct fishing analyses, which is financed by tax-payers and yet is not available for public use. Only IFOP researchers and employees of the Under-Secretariat, who are responsible for generating and financing this data, have access to it.
- Despite the advances of the fisheries institutions in recent years, neither the current legislation nor the recently-discussed plans to amend it contemplate the creation and funding of technical committees and work groups which would be responsible for the revision and modification of all aspects of management proceedings, such as observation protocols, data analysis, stock assessment methods, rules for controlling the catches, etc.

- The lack of effective mechanisms for cooperation between the industry and the organizations responsible for research and management. The Fisheries Under-Secretary is reluctant to accept the technical support of those who work in the industry. Arguments that there is a lack of objectivity because of interests tend to hinder collaboration and limit the possibilities for discussing new ways of cooperating. The industry is visualized as a possible contributor in terms of logistics and material for conducting research, but not as a possible and legitimately for initiating research that is of common interest. This is related to the underlying idea that only certain researchers or institutions could have access to the reality that would allow them to be objective, rather than a more open focus that accepts the coexistence of multiple interpretations and proposes that diverse hypotheses be considered for selection based on the quality of their observation protocols and their scientific merit.

3. WHY IS FISHERIES MANAGEMENT SUCCESSFUL (OR NOT)?

Factors of unsustainability are as follows.

1. The subsidies were transitory factors that promoted the development of the fishery and were important in its origin. However, beyond the initial thrust that they gave to its development, the banking system's excessive and constant financial support, based on unrealistic expectations of the abundance, and the application of high discount rates for the investment projects had a significant distorting effect on investment.

2. The policy of free access and the promotion of foreign investment have been the driving forces that historically have dominated the scene of fishing development. The efforts that have been made until now to control the investment process have not been sufficient and the different manifestations of the prevailing neo-liberal economic model constantly threaten the timid advances that have been achieved. In particular, the policy of opening the country to external capitals, which has been one of the pillars of economic growth of all of the presidential administrations in the past 40 years, has generated a propitious framework to continue a policy of free access, although in the practice a majority of the investment comes from within.

3. The social inequity of the economic rationalizations applied in each crisis. By means of the optimization of the costs, these rationalizations have stimulated the concentration of the industry in the hands of a select group, mainly favouring the industrialized sector and transferring a good part of the costs to the State and the local communities that depend on fishing. There is notorious social inequity in these practices: while the profits are for private use, the costs are shared.

4. The high demand in external markets, and recently in the domestic salmon feed industry, for limited and very accessible fisheries resources is an ever-present factor of unsustainability; however, an equally important but less evident factor has been the "virtual" demand of the financial markets that exacerbated the pressure for short-term exploitation. An important portion of the capital generated by the fishing industry became separate from the productive process and the real markets, transforming into "paper fish" that the speculative financial management multiplied various times.

5. The little relevance that the objectives of equity and conservation have had in the policies for the development of the fishery, as compared to the key objectives of growth and economic efficiency. To achieve a compromise among multiple objectives is a difficult task. On one hand, the search for economic growth has caused an increase in the catches with the consequent risk for conservation. On the other hand, an increase of competition often leads to the concentration of property and capitals to the detriment of a more equitable distribution of the activity's benefits. The sectors that work in industrialized and artisanal fishing are particularly vulnerable to this type of inequality, which generates poverty and affects job alternatives and quality of life.

6. Given the scenario of open access, the price of fishmeal has tended to increase while the costs of the effort have remained low. The combination of these two trends, together with the high

technological efficiency of the fishing operations and the environmentally-induced fluctuations in the abundance, have generated biological overfishing and the successive collapses of the main resources that have sustained the fishery through the years.

7. The existence of weak institutions in the public fishing sector, lacking in technical knowledge, strategic planning abilities and authorities able to resolve controversies, together with the necessity of better organized opportunities for participation that could serve as channels for multiple conflicts of interests principally at the regional and local levels.

8. A rigid legislative framework with excessive regulatory details that tend to produce difficulties in its revision and adaptation to new emerging situations and without an adequate incorporation of the precautionary approach and the ecosystem approach. In addition, the lack of regulations and management proceedings established by the administration in order to implement the principles and concepts of the precautionary and ecosystem approach, to incorporate them further into the decision-making process and implement them through regulations.

9. The weakness of fisheries research. There are at least two important elements. In the first place, the crisis of the sequential paradigm of the research-action pair, that is, the concept that there is a linear sequence from knowledge to action which starts with scientific knowledge that is validated by its own methods, before the action, and then applied. At present, the concurrence or simultaneity of the research and the action has been very important in the management of fisheries resources. The crisis of the sequential paradigm is evident in the reactive nature of research, in the paralysis or dilation of action, the solution of specific problems, the improvisation, the excessive emphasis on the implementation of the routine management proceedings related to the calculation of the TAC to the detriment of research oriented toward problems and processes. Second, the reductionist approach, in contrast to the systemic approach, which eludes the complexity of the fishery and the fishery management system.

10. The weakness of the scientific advising, which is evident in the lack of organization, in the management of the uncertainty of the stock assessment.

11. The simultaneous processes of centralization and isolation of fishing affairs, which make it difficult to visualize the interactions of the fishing sector with other economic sectors and to coordinate policies and actions that contribute to a generalized economic development.

4. HOW CAN THE DIFFICULTIES AND OBSTACLES BE OVERCOME?

Paths to a solution are as follows.

1. Both the positive role of investment in the take-off of the industry and the threat of over-investment to sustainability have been mentioned. The investment can be excessive in fleets and plants, but investment in infrastructure, research and the development of human capital (for example education and training of artisan fishermen and the industry’s workers) is also important. The investment in these factors is necessary and should be stimulated. A growth policy is an investment policy, and an investment policy directed at obtaining profits should make the decision to invest profitable for each company. This means establishing some type of subsidy in support of this type of investment that contributes to the sustainable growth of productivity.

2. The control of the factors that determine the discount rates is beyond the scope of the administrative measures of the fishing sector and is a topic whose solution is not easily imaginable. It is not possible to make the same observation with respect to the overly optimistic expectations of the sizes of the stocks, which could be corrected by supplying better information to the financial system on the state of the stocks of the resources and their future projections, with the goal that it be considered in the economic evaluation of investment projects.

3. The perfecting and consolidating of the individual quota system recently implemented by the fisheries law under the name of maximum catch limits per fleet owner, with respect to aspects such as their transferable and temporary nature, collective allocations to local communities and to artisan fisher groups, transparency in the legislative process, mechanisms that ensure the entrance of new economic agents.

4. The lack of markets for the catch in which the optimization by means of prices/quality is favoured instead of the optimization via the costs, which has prevailed. This factor will be especially important in the future due to the growing contribution of the artisan sector to the supply of the industry, both for fishmeal and for products for direct human consumption. To create first hand auction markets for the artisan fishers' catch could be a stimulus for innovation, the improvement of quality, and the entrance of new agents who can compete through prices. This should be supported by a government policy oriented toward promoting value in the market for the catches.

5. The immediate solution to the growing demand for limited resources is the limitation of the exploitation rate to sustainable levels, that is, regulates the supply. Evidently this is very difficult to achieve given the increasing prices that tend to motivate further exploitation, which are exacerbated by the tendency of the resources to fluctuate highly. One way to protect the community associated with the industry is to save the extra income from the resource, which is produced by the introduction of the allocation mechanisms mentioned previously and introducing mechanisms for an inter-seasonal redistribution of the profits that could mitigate the social and economic consequences in times of scarcity and unemployment, creating a stabilizing fund for this purpose.

6. Part of the social problems and inequity could be resolved with such a stabilizing fund, but there would still be structural imbalances that would tend to perpetuate and augment the distributive inequality that generates tensions and poverty. A government concerned about social equity and the maintenance of sustained growth in the long term would actively seek to reduce the inequalities by promoting a legislative framework that would regulate the relationship between workers and entrepreneurs in a stable and consensual way, support labour organizations and negotiating opportunities, improve the redistribution of the income and promote the development of human capital.

7. Ensure that technical regulatory institutions acquire solvency and technical excellence that allows them to turn into an effective arbitrator among the other actors in the decision-making process by incorporating qualified and well-paid personnel and offering them appropriate promotion opportunities.

8. The capacity-building of administrative entities in order to create State policies that lead to long-term Fishing Policies and Management Plans, which would transcend the political and time-related limitations of a presidential administration and achieve high levels of consensus that would ensure their prolonged stability.

9. The creation of a system for participation that would organize spaces that would allow not only the users but also common citizens to participate effectively in designing policies for conservation, efficient and equitable resource use and holding the fishing sector authorities accountable. This same system would provide the relevant information that would stimulate participation and the formation of opinions.

10. In the legislative area, promote the development of a framework law that would indicate the main elements and principles of the precautionary and ecosystem approaches that should take shape in the regulations and management proceedings, which would allow these approaches to be implemented in the administrative area and the decision-making process.

11. Promote a more participatory, collaborative and transparent system of scientific research and advice, in accordance with the international recognition to which Chile aspires, which would improve the quality of the decisions in the context of the requirements imposed by a market economy that tends toward higher and higher levels of globalization.

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DISCUSSION PAPER 3

BIOLOGICAL OVERVIEW OF TUNAS STOCKS AND OVERFISHING

by

Dr Alain Fonteneau[31]

Summary

Tuna resources have been classified by scientists as well as by lawyers (law of the sea) as being highly migratory species. Among the 49 species of scombrids fished world wide, one should note that only six tuna species constitute the group of "major tunas" that are heavily fished by various industrialised countries and targeting the two main markets for tunas, namely canneries and sashimi. On the opposite, various species of small tunas are often fished by coastal small scale fisheries for local consumption, but most of these stocks and fisheries are poorly followed by scientists and they will not be examined in this paper.

The major tuna are the two species of bluefin (*Thunnus thynnus* and *Thunnus thynnus maccoyii*), yellowfin (*Thunnus albacares*), skipjack (*Katsuwonus pelamis*), bigeye tuna (*Thunnus obesus*) and albacore (*Thunnus alalunga*). World catches of these tunas have been showing during the last half century a quite steady increase (shown by figure 1). Such trend is nowadays seldom observed when many fish stocks are increasingly overfished; this positive trend seldom observed for coastal resources, could suggest that tuna stocks world wide are not yet overfished. This paper will compare the status of the various tuna species and stocks world wide, discussing their present rates of exploitation, in relation with their potential overfishing. The serious difficulties faced by scientists world wide to estimate the real status of tuna stocks and their overfishing risks will also be discussed. This document will also present and discuss the past and potential problems of by-catches by the various tuna fisheries and the collateral potential effects of tuna fisheries on the pelagic ecosystems, knowing that these effects could have serious negative impacts on various tuna fisheries.

1. DEFINITION OF OVERFISHING

It is important first to give the basic definition of the biological overfishing. "Overfishing" can be used to mean different things.

- "Growth overfishing" corresponds to a situation where the fishing mortality (or fishing pattern) is such that fish are caught before they have a chance to reach their growth potential. Fishing less or with a better exploitation pattern would result in higher total catches. The low catch rates corresponding to this situation may not be profitable in economical terms (unless when these fishes are sold at a very high price).
- The term "Local overfishing" describes a peculiar case of growth overfishing. This is a situation where the observed catches are not increasing as a response to higher local fishing mortality. This type of local overfishing can be sustainable in biological terms when the stock itself is in good shape, but the low catch rates and stable catches corresponding to this situation may not be profitable in economical terms.
- The term "recruitment overfishing" describes a situation where an excessive fishing mortality has produced an excessive decline of the spawning stock, and consequently low recruitment. This recruitment overfishing may lead to a temporary or long term collapse of the stock.

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2. WORLDWIDE SIMILARITY OF TUNA STOCKS, TUNA FISHERIES AND PELAGIC ECOSYSTEMS

Tuna are fished worldwide in all the oceans between 50°N and 45°S, but mainly in the intertropical areas (figure 2). All tuna species are classified as being "highly migratory" species. This typical status is often fully justified: this is for instance the case for southern bluefin tuna, a species showing large migrations between its feeding and spawning areas around the Antarctica in the Atlantic, Indian and Pacific oceans (see figure 3). Northern bluefin in the Atlantic and Pacific oceans are also showing such permanent wide scale migration. However, it should be noted that there is an increasing recognition among tuna scientists that most tropical tuna species often do show limited movements, at least during long periods of time. This problem was first expressed in the provocative paper published in 1986 by Hilborn and Sibert: "*Is international management of tunas necessary?* Since that time, many results obtained from tagging have confirmed that in many cases the geographical scale of these movement patterns is quite limited. As a consequence, it appears that if tuna should still be considered as being highly migratory species inhabiting wide oceanic areas, they also often do show some "stock viscosity", as proposed by Mac Call 1990. Following this concept, significant fractions of the tuna populations could be highly "viscous" and showing limited movement during large periods of time.

The first important point to keep in mind in the comparison of overfishing risks faced by the various tuna stocks world wide is the between oceans similarities in the Pacific, Indian and Atlantic oceans:

- All these tuna species are the same in each ocean and show very similar biological and behavioural characteristics.
- They are fished by multigear fisheries (mainly purse seiners, longliners and pole and line vessels) that are nearly identical in all the oceans world wide; furthermore many of the industrial fleets are mobile from one ocean to the other.
- They live in offshore and coastal pelagic ecosystems that are typical of each ocean, but showing similar global characteristics in their structure and fauna (similar associated species: sharks, billfishes, turtles, etc) and similar rates of specific by-catches (see section 6 below).

There is then a major potential field of investigation in the between oceans comparisons of tuna stocks and their increasing exploitation by multigear tuna fisheries. Furthermore this potential for comparative analysis of tuna overfishing mechanism is widely facilitated by the histories of the fisheries in each ocean: while the Eastern Pacific has been showing 30 years of apparent growth overfishing, the Western Pacific stock is still experiencing a moderate exploitation rate. The same comparison will be also valid between the Atlantic (where tuna purse seine fisheries have been very active for 40 years) and the Indian Ocean (where active tuna fisheries have been developed only since the early eighties with the arrival of a large fleet of purse seiners).

However, one of the difficulties faced in these interesting and comprehensive "between oceans comparisons" is due to the heterogeneity between the various tuna Commissions: each tuna Commission has been created at a given time and when the pressure on tuna stocks became a source of worry (IATTC[32] in 1949, ICCAT[33] in 1968, IOTC[34] in 1993 and the beginning of 21st century for the Western Pacific). Their scientific work is thus not covering comparable periods. Furthermore each of these tuna bodies has a particular framework and uses particular models to do their stock assessment. Subsequent detailed comparisons of their results are then quite difficult. Comparative analyses between oceans were seldom done, and it is often quite difficult to do in depth comprehensive comparisons of the tuna stock status between oceans.

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[32] IATTC : Inter American Tropical Tuna Commission

[33] ICCAT : International Commission for the Conservation of Atlantic Tuna

[34] IOTC : Indian Ocean Tuna Commission

3. HETEROGENEITY BETWEEN TROPICAL AND TEMPERATE TUNAS

It is increasingly admitted that tuna species are showing a great resilience to overfishing. This characteristic is probably due to their very large habitat, as tunas are living in wide areas (a total area of about 140 million nautical miles^2), scattered in a wide range of depth (over 500m). This situation leads to cases where, in relation with stock viscosity, various fractions of tuna stocks remain "cryptic" because they are not highly mobile and/or too deep or too remote to be caught significantly. It is expected, that over time, the refuges will become progressively fewer and fewer and the risk of overfishing will therefore, increase.

However, the biological and behavioural differences between tropical tunas (such as yellowfin, skipjack and bigeye) and temperate species (such as bluefin) are important factors to keep in mind in relation with the risks of overfishing faced by the various tuna stocks. The increasing fishing pressure world wide on these two groups of tunas tends to be quite different.

- Tropical tunas such as skipjack (and yellowfin) tend to show a high biological productivity, a short life span, a fast growth and an early massive spawning done successfully in a wide range of time and area strata. Furthermore these species tend to be widely scattered in vast equatorial and subtropical areas in most of their life. The market price of these species tend to be quite low (most often less than 1.5 US$/kg).
- On the opposite, temperate tuna stocks such as bluefin tend to have quite large standing stock but with low biological productivity, a long life span over 20 years and showing a late spawning (an age of over ten years for southern bluefin); furthermore, their spawning is done during short seasons and in given small areas. An additional risk faced by bluefin is due to the seasonal concentration of adults in their feeding and spawning zones, where they are easily caught by fishing vessels. The market price of these species tends to be very high increasing the risk of overfishing.

As a consequence, it appears that *de facto* tropical tunas like skipjack (or yellowfin and bigeye) tend to be much more resistant to both growth and recruitment overfishing than temperate tunas such as bluefin. This resistance is also well confirmed by simulation studies that are built combining the biological characteristics of these stocks (Fromentin and Fonteneau 2001).

4. COMMON DIFFICULTIES FACED BY SCIENTISTS TO ASSESS TUNA STOCKS

It can be concluded, after 50 years of active research done world wide upon tuna stock assessment, that it remains extremely difficult to estimate tuna stock status with a full confidence. As tuna stocks cannot be sampled directly by scientific vessels, most of the analyses done by scientists are entirely dependent on fishery data. On the other hand, it is now well proven that most tuna fisheries are permanently changing their behaviour, their fishing zones and fishing depth, improving their fishing efficiency, as well as changing their size and species selectivity.

All these changes have been introduced by fishermen in order to improve their catches and their catch rates, leading to drastic changes and spectacular increases of fishing efficiencies. For instance, one should note among the major changes observed in tuna fisheries the effects, on tuna fisheries as well as on tuna populations, of multiple Fish Aggregating Devices (or FAD) that are widely increasing the catches of small tunas world wide. These FADs have been introduced massively in all equatorial areas by tuna fishermen; they have increased the efficiency of most purse seiners world wide (about 50 percent of purse seine catches being taken world wide under FADs), but the negative impacts of these FADs are still widely unknown (mainly because natural mortality of juvenile tunas is also poorly known).

These increases of fishing efficiency are probably observed for all gears catching tunas world wide (purse seiners, longliners, baitboat and others), but they remain very difficult to measure in the absence of scientific data. Tuna fisheries represent a typical case were the growth overfishing of stocks can be generated by technological progress, even when the nominal carrying capacity of the fleets remain stable (case of the Atlantic and Indian Ocean). Unfortunately there is very little use of acoustics to allow estimating stock sizes, primarily because tuna schools and isolated individuals are very rare, and extremely difficult to locate in their vast oceanic areas.

In general, data sets that are somewhat independent of fisheries have been provided by large scale tuna tagging programmes (allowing the evaluation of stock sizes, as well as natural and fishing mortalities). However, such programs are expensive and seldom conducted by the tuna commissions. One of the consequences of this lack of tagging data is that the movement patterns of most tuna stocks remain insufficiently known by the tuna commissions, when this information would be essential to establish the best stock structure hypothesis used by scientists to evaluate stock status and by commissioners to manage these stocks (Hunter *et al* 1986). Among these typical scientific uncertainties, one should note the major uncertainties still faced for the stock structure of bluefin tuna in the North Atlantic: a two stock hypothesis has been used by the ICCAT since the early eighties, but is increasingly in contradiction with tagging results.

These difficulties that are typical of tuna stock assessment have been worsened during recent years by the increasing difficulties to obtain reliable statistics on major fleets: increasing numbers of ghost fleets are poorly followed world-wide and increasing catches by Illegal Unreported and Unregulated (IUU) vessels were observed world wide during the last 10 years by most tuna commissions. These statistical difficulties are obviously worsening the intrinsic difficulties already faced by models that are working exclusively on already biased fishery data.

As a consequence, and despite a wide variety of models used by the various Tuna Commissions, too many retrospective analysis done upon previous stock assessments are showing that the previous diagnosis on stock status were quite often dubious or inaccurate. It appears *a posteriori* that these diagnoses were valid ones, but only in the context of the fisheries active at that time (in a given area and at a given depth), but were not correct at the level of the real global stocks. Most often, tuna stocks were more resilient and more productive that estimated by the various models used by scientists.

5. BRIEF OVERVIEW OF PRESENT STATUS OF TUNA STOCKS WORLDWIDE

5.1 General points on tuna overfishing

Many tuna stocks are not yet showing serious symptoms of overfishing, the permanent increase of total tuna catches observed during the last 50 years being dominated by tropical tuna catches (mainly skipjack and yellowfin). However, there is in the world of tunas fisheries a wide range of situations, varying between healthy stock with still large potential for increased catches (mainly skipjack), when several other stocks are being growth overfished, and a few are already facing a dangerous recruitment overfishing (such as southern bluefin). One difficulty to evaluate the real status of tuna stocks is to interpret the changes in the Maximum Sustainable Yield (or MSY) estimated by the various tuna commissions: it is clear for instance that the Eastern Pacific and Eastern Atlantic yellowfin stocks have been classified during many years as being growth overfished. However, wide increases of MSY were estimated by scientists (figure 4) when the fisheries were expending their geographical range of operation towards offshore areas (Laloë 1989) (see figure 5, the Atlantic yellowfin example) and also fishing deeper and more efficiently. This tendency to underestimate tuna stock MSY and to overestimate their rates of overfishing should always be kept in mind in the discussion of past tuna overfishing.

The following paragraphs will briefly review the present situation and prospects for overfishing of some major tuna stocks, tropical and temperate: skipjack, yellowfin, bigeye and bluefin stocks being taken as examples.

5.2 Skipjack tuna

Skipjack tuna catches have been showing steadily increasing trends in the Indian and Western Pacific oceans (figure 6). These two stocks are producing record catches (reaching 400 000 tonnes in the Indian Ocean and over 1.2 million tonnes in the Western Pacific), but they are not yet fully exploited. The same diagnosis of low exploitation rate has been obtained by the IATTC in the Eastern Pacific, where skipjack catches are widely fluctuating, at less than 200 000 tonnes the highest catches being observed during recent years in relation with FAD fisheries. In the Atlantic, skipjack production has been flattening during the last six years at about 150 000 tonnes despite of a massive use of FADs that were used primarily to increase skipjack catches; there are serious indications, for instance its seriously declining average weight, that this stock is close to be overfished and possibly overfished in various areas. This local overfishing was possibly in relation with an excessive use of FADs (it should be kept in mind that the seasonal moratorium on FAD fishing in the equatorial areas may have contributed to these reduced skipjack catches).

As a conclusion, skipjack tuna is clearly a species showing biological characteristics, large biomass and high productivity, that allow these stocks to be resistant to overfishing. However, the Atlantic example would tend to show that such strong stock can also be overfished at large geographical scales.

5.3 Yellowfin tuna

Yellowfin tuna is a typical tropical tuna. Its total catches world wide have been showing a steady increase during the last 50 years but catch trends (figure 7) and the situation of yellowfin stocks are highly variable between oceans.

In the west Pacific, it appears that the yellowfin stock is still in good shape but approaching its MSY. In the Indian Ocean, MSY was probably reached and possibly exceeded five years ago. On the opposite, it appears that in the Atlantic, yellowfin stock has been suffering a moderate growth overfishing during more than ten years.

In the Eastern Pacific yellowfin stock the scientific diagnosis has been that the stock was already growth overfished during the late sixties. It was subsequently managed actively by an IATTC quota system since 1966, but there is some controversy concerning the reality of this historical overfishing: in fact the yellowfin purse seine fishery was catching less than 100 000 tonnes during this early period, but mainly in coastal areas (see figure 5). As sustainable total catches of about 300 000 tonnes were taken during recent years in a much wider area of the eastern Pacific, there are strong reasons to consider that the total stock of yellowfin was not yet really overfished during the late sixties and seventies when the IATTC quota system was developed by the IATTC in the coastal areas (keeping in mind that the biological productivity of the stock may have been increased during recent years because of environmental reasons)(Polovina 1996). This stock provides another example, similar to the Atlantic and Indian Ocean cases, showing that the MSY of many tuna stocks can be reached only when large fraction of their geographical distribution is actively exploited by fisheries. When only a small fraction of the total stock is exploited by fishery, the apparent local MSY tend to be lower than the real productivity of the stock (Laloë 1989). This fact is probably related to the viscosity of tuna stocks.

5.4 Bigeye tuna

Bigeye tuna is a tropical species showing some similarities with temperate species, such as its wide habitat sometimes in temperate waters, and its affinity to inhabit deep and cold waters. Bigeye tuna stocks and fisheries have been showing similar patterns worldwide during recent years. Large increases of small bigeye catches were observed during recent years for the surface fisheries (in relation with the use of FADs), while large increases in large fish catches were also observed for longliners targeting large bigeye sold at high price to the sashimi market (mainly but not only in

Japan). These increased catches were mainly due to a specific targeting of bigeye tunas using deep longline. The Atlantic bigeye, a stock well assessed by the ICCAT since the early eighties, can be taken as the typical bigeye scenario of bigeye growth overfishing The recent increase of catches has produced, during the mid nineties, catches that were well above the previously estimated MSY (figure 8). As this excess of catches was widely obtained on small individuals, there was a serious concerns based on all projections done by stock assessment models, that the stock would soon be facing a severe overfishing. After nearly 10 years of this regime of high catches, it appears that the MSY previously estimated by scientists were too low. In fact the present status of the Atlantic bigeye stock is not yet fully understood by scientists.

5.5 Bluefin tuna

World catches of bluefin tunas (northern and southern) have been fluctuating at less than 100 000 tonnes during the last 50 years (figure 9). Bluefin tuna is mainly sold at a very high value as raw fish on the sashimi market, mainly Japan, but also increasingly in other countries. The very high value of this species is worsening its pressure to be overfished as fisheries can be profitable even at very low cpue. As an example, during recent years, the average cpue of Japanese longliners was five times lower when targeting southern bluefin in the southern sea, compared to the cpue of the same boats fishing in the equatorial area (targeting a mixture of tropical tunas, mainly yellowfin and bigeye).

Among these potentially fragile species, southern bluefin provides the best example of a tuna stock recruitment overfishing. This stock was already overfished during the late sixties by large fleets of longline fisheries catching adults. This overfishing has later been worsened by an additional fishery of purse seiners catching juvenile bluefin. As a result, the stock has been suffering since the late eighties a long period of low spawning biomass and of low recruitment that is typical of recruitment overfishing. Despite more than 10 years of low quotas, its spawning biomass and recruitment remain low, and the prospects for a medium term recovery of this stock are still uncertain despite of the firm control of fisheries by CCSBT[35].

On the other hand, northern bluefin in the Atlantic has been heavily and increasingly exploited at all sizes (juveniles and adults) in the Atlantic and Mediterranean Sea (same stock). This stock seems to be under serious threat, following the uncontrolled and massive increase of its catches (for both juveniles and spawners). This tendency has been severely worsened during recent years by the increased value of all sizes of bluefin tuna that are sold alive to coastal farms where tunas are fed during several months (including fishes caught at illegal sizes, and growing at the farm to reach the ICCAT legal size). All the various management measures taken by the ICCAT since the early seventies (limiting fleet sizes, size limit and quotas) appear to have only limited or no effects on the fisheries. The present high catches on this stock during long periods, are in fact quite surprising for many scientists. Such high catches are against most previsions done by the previous ICCAT stock assessment models. However, there is probably a great risk that the present fishery will produce in the short or medium term a recruitment overfishing comparable to southern bluefin. It should also be noted that this risk may also depend on the environment variability and trend, because it has been shown that this Atlantic bluefin tuna stock has been showing long terms natural fluctuations as a function of environmental variability (Ravier et Fromentin 2001).

5.6 Strange cases of local extinction: shrinking areas?

It appears that while tuna stocks are quite hard to overfish at a global oceanic scale, they may be easily overfished at a local scale: the general rule of fishery science that too much local fishing effort tend to decrease the local biomass and cpue is also valid for all tunas resources. This quite logical rule has been observed for many tuna fisheries: local overfishing of fractions of tuna stock can be observed for a stock which is still in good shape at the oceanic level. In general, this local overfishing tends to disappear when the local fishing effort is reduced (following movements between neighbouring fractions of the same stock).

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[35] CCSBT : Commission for the Conservation of Southern Bluefin Tuna

However, it appears that many strange local effects have been observed in various tuna fisheries, possibly but not necessarily in relation to stock overfishing. Among the best examples, one could cite three cases observed in the Atlantic:

- Bluefin tuna vanishing from Brazilian and Norwegian coasts where they were abundant in the early sixties (Brazil) and fifties and sixties (North Sea, mainly Norway);
- Yellowfin vanishing from Angola during the early seventies. (ICCAT Stat. Bull.) and from Senegal during the nineties (Hallier and Marec 1998);
- Bigeye vanishing from Azores during the nineties (recent ICCAT SCRS reports).

All these examples are dealing with large tunas fished at the limit of their geographical distribution. Interestingly, none of these surprising changes has been thoroughly studied and they remain widely unexplained by scientists. They may indicate a shrinkage in the area of distribution, but the causes of such a change are not understood: as a function of environmental changes, of stock sizes, or due to other reasons?

6. POTENTIAL EFFECTS OF TUNA FISHERIES ON PELAGIC ECOSYSTEMS

The potential negative effects and disequilibrium exerted on pelagic ecosystems by tuna fisheries remain widely unknown, but they are a source of increasing concerns for most tuna Commissions and in several countries (Fonteneau and al 2002). Discards by tuna fisheries tend to be quite moderate at a worldwide scale, and they are scattered over the wide oceanic areas fished. They however, remain poorly estimated by scientists due to the lack of observers in most tuna fisheries. The worse uncertainties are probably faced for longliners (a gear showing large discards in some strata); while discards by purse seiners tend to be better sampled and quite moderate (most often less than five percent of tuna catches). Pelagic ecosystems worldwide are very large and deep, and they appear to be much less threatened by tuna fisheries than the continental shelves fished by bottom fisheries (at least until now).

However, two types of environmental risks can easily be identified for tuna fisheries.

- The by-catches of sensitive and sometimes threatened species such as dolphins, turtles, birds and various species of sharks that are sometimes taken by various tuna fisheries. Tuna fisheries may accelerate the critical stage of these sensitive species. Good examples of this type of interactions have been faced by the Eastern Pacific purse seine fisheries killing too many dolphins in the mid seventies and recently by the Hawaiian longline fisheries because of turtles accidental mortality. In both cases the activities of these tuna fleets had to be temporarily stopped because of such accidental mortality of an undesired species (dolphin problems have been solved by the IATTC). Various species of sharks are now increasingly threatened by tuna fisheries. There is a serious concern that in the future this type of problem could be increasingly faced by tuna fisheries.

- The major increase in the catches of oceanic top predators (such as tunas, sharks and billfishes) by the various tuna fisheries world wide has, during recent years, been producing a serious decrease of the summit of the oceanic food pyramid. The potential effect of such decline is not clear (keeping in mind the fact that this pyramid of pelagic biomass remains nearly unfished and virgin in all its lower components). All the potential top-down effects of this removal of predators on the food chain, especially the removal of some predators that are possibly playing a role of “key stone species” in the ecosystem (Paine 1966), remain widely or totally unknown. Similarly, the risks of changing interactions between the declining populations of the various species of top predators (including between tuna species) remain entirely unknown for scientists. As a whole, there are no doubts that these risks have been permanently increasing with the increase of the catches of tunas, billfishes and sharks world wide, and the probably large decline of their biomass. A precautionary management of tuna fisheries should take into account these risks.

7. CONCLUSION

After fifty years of increasing exploitation experienced worldwide by all major tuna stocks, it can be concluded by scientists that most of these stocks have well shown their resilience to overfishing, at least much more than most coastal resources. Many biological and behavioural reasons, as well as the great sizes of pelagic ecosystems, do help to understand this resilience. However, this historical overview is already tarnished by various tuna stocks that appear to be already growth overfished. Nowadays, there is probably little hope to see further significant increases of sustainable catches (for most tuna stocks world wide) in the future, as the entire habitat of most stocks is now more or less fully explored and fished by fishing fleets already highly modernized and very efficient. Taking into account the permanently increasing demand of the word tuna market for fresh, canned and sashimi tunas, as well as the structural difficulties to limit the activities of tuna fisheries, there is then a high risk to see increasingly large numbers overfished tuna stocks in the near future. There is also an unknown additional risk to face world wide in the future the still unknown top-down effects of this increased pressure on the pelagic ecosystems.

FIGURES

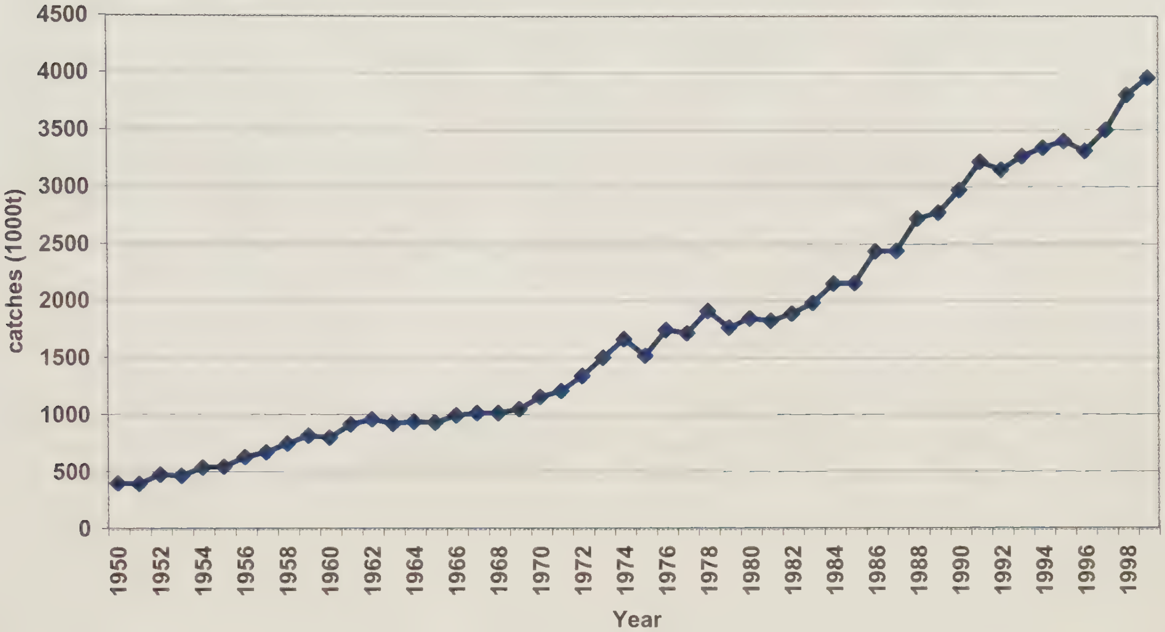

Figure 1: Yearly catches of major tunas (skipjack, yellowfin, bigeye, albacore and bluefin tuna) world wide

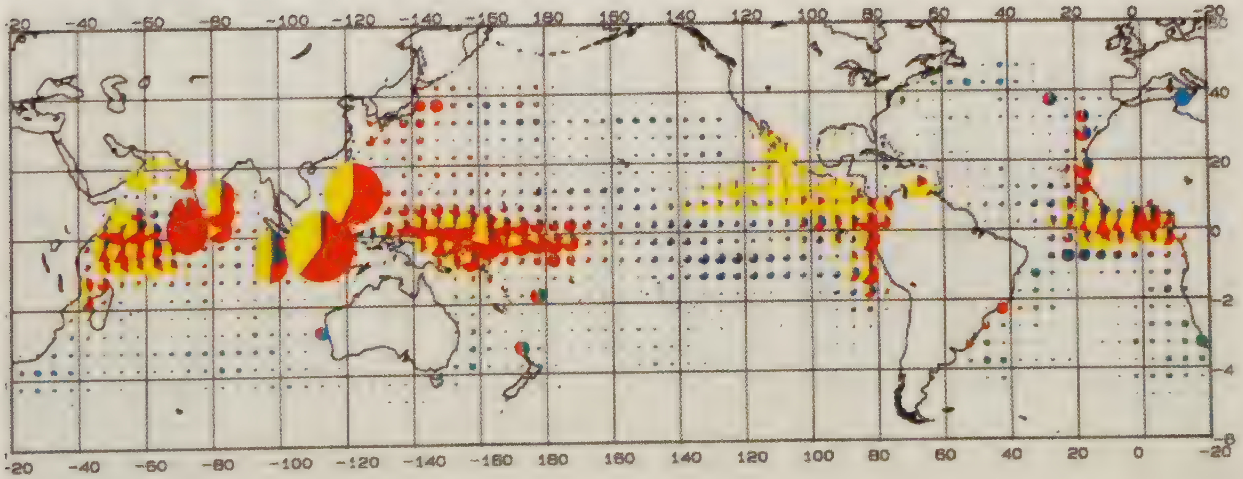
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Figure 2: Map showing the average distribution of recent tuna catches (major species only)

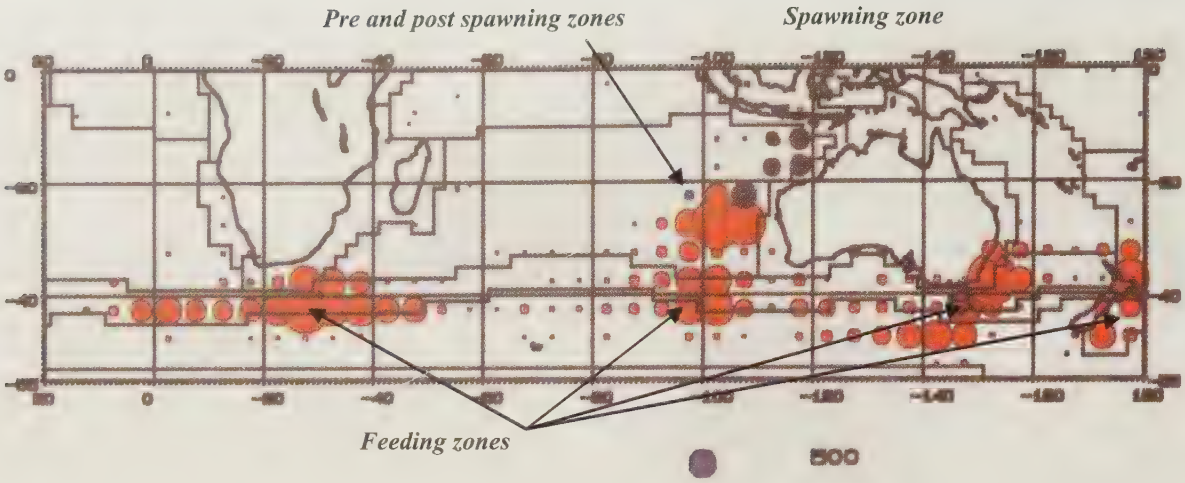

Pre and post spawning zones
Spawning zone
Feeding zones
500

Figure 3: A case study of tuna migrations: average historical catches of southern bluefin and movements between its spawning and feeding areas

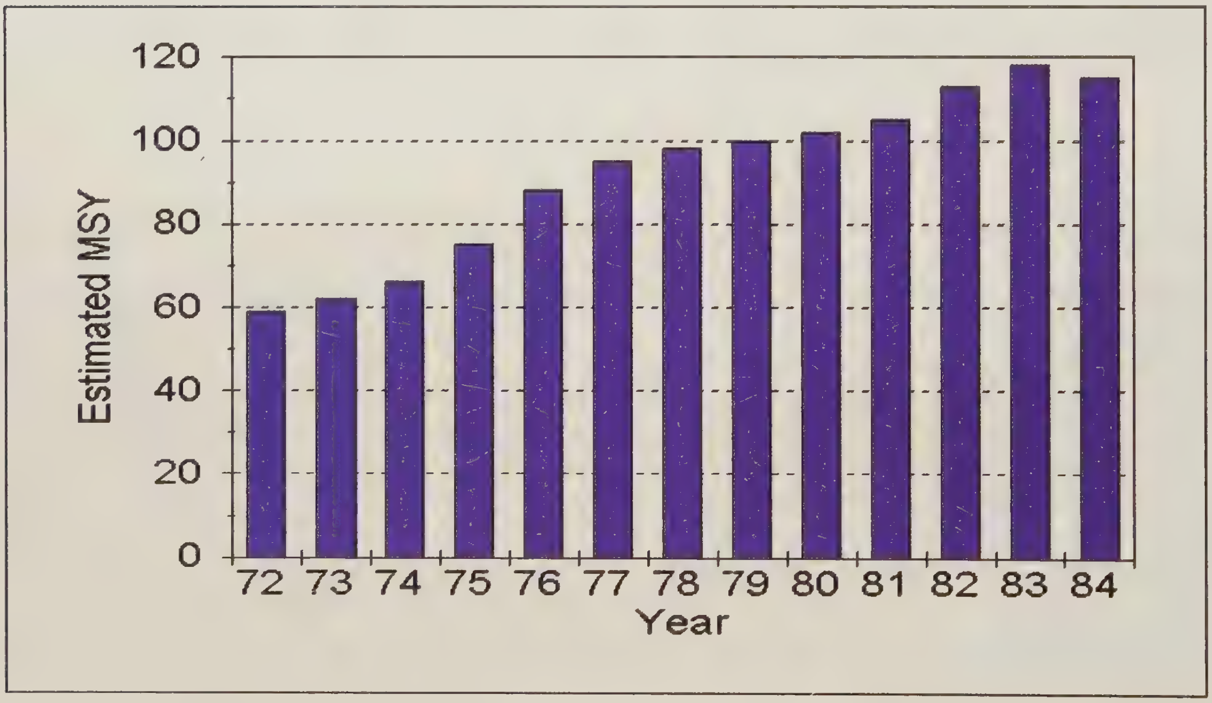
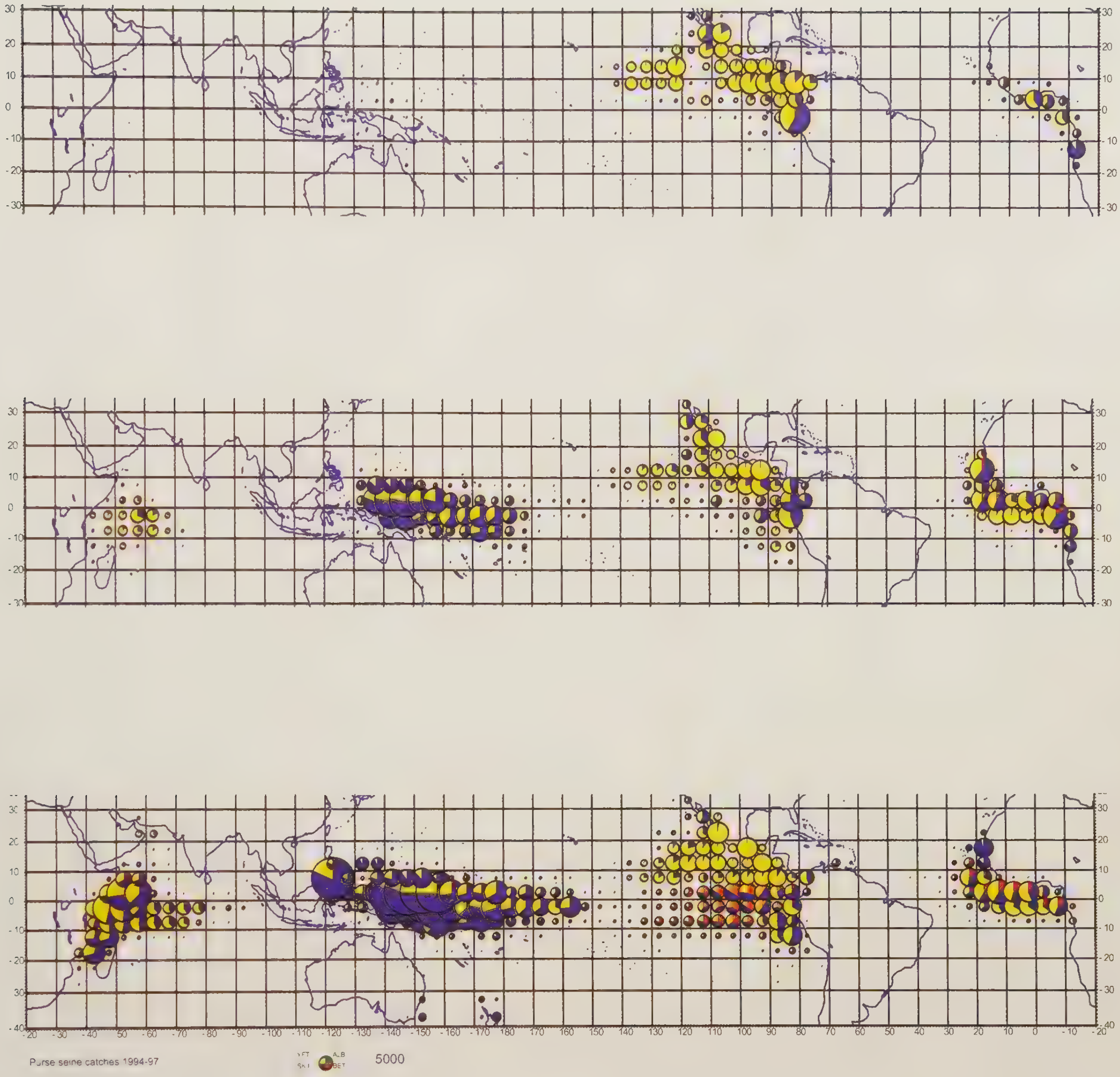


Figure 4: Changes in the East Atlantic Yellowfin MSY estimated by production models during the period 1972-1984.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70
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50
40
30
20
10
0
-10
-20
Purse seine catches 1994-97
YFT
SKJ
ALB
BET
5000

Figure 5: Average tuna catches by the purse seine fleets worldwide (yellowfin, skipjack and bigeye) during 3 periods: 1970-1973 (upper figure), 1982-1985 (middle) and 19941997 (lower figure. These maps well show the increase of fishing zones by purse seiners during the last 30 years.

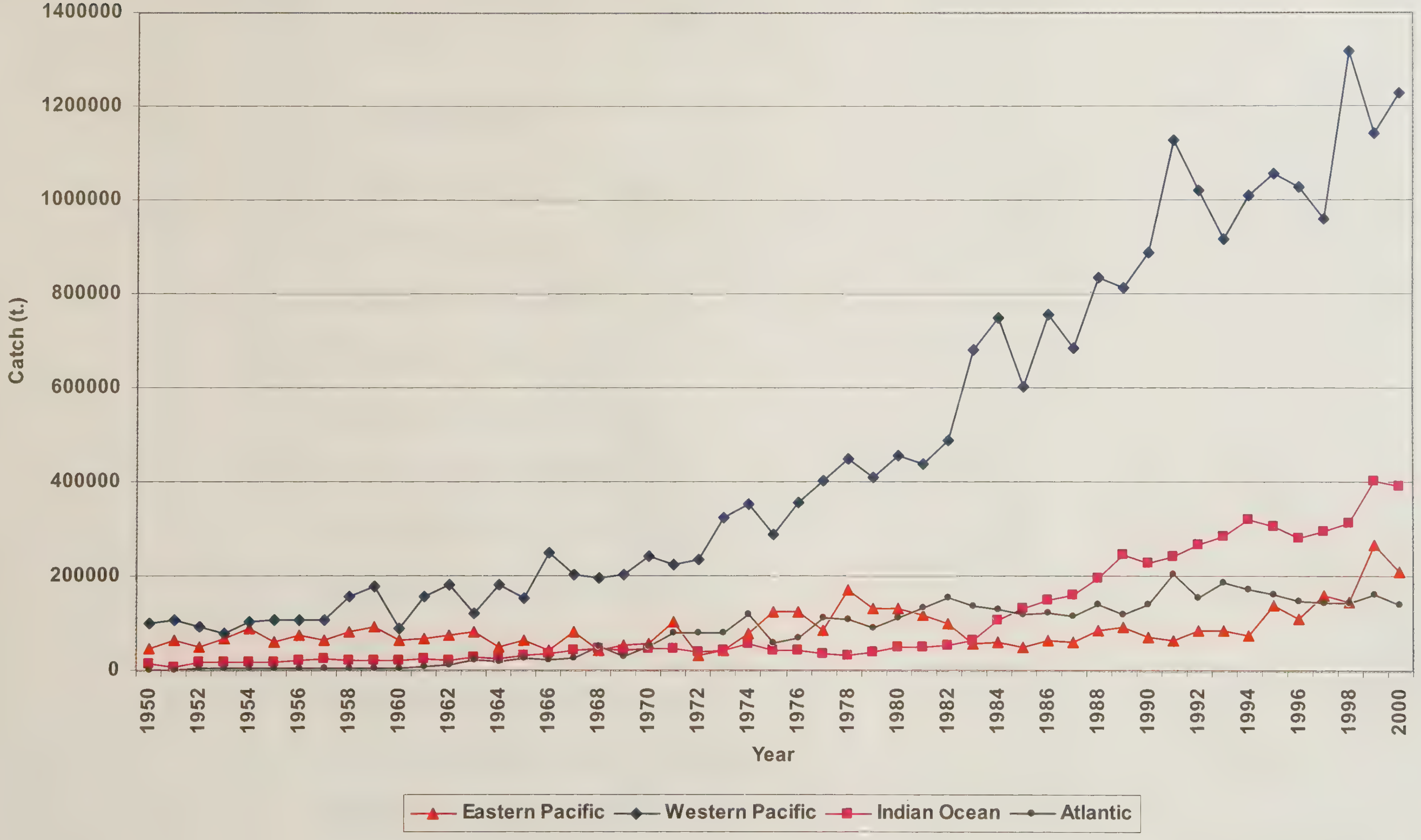

Figure 6: Annual catches of skipjack tuna by area.

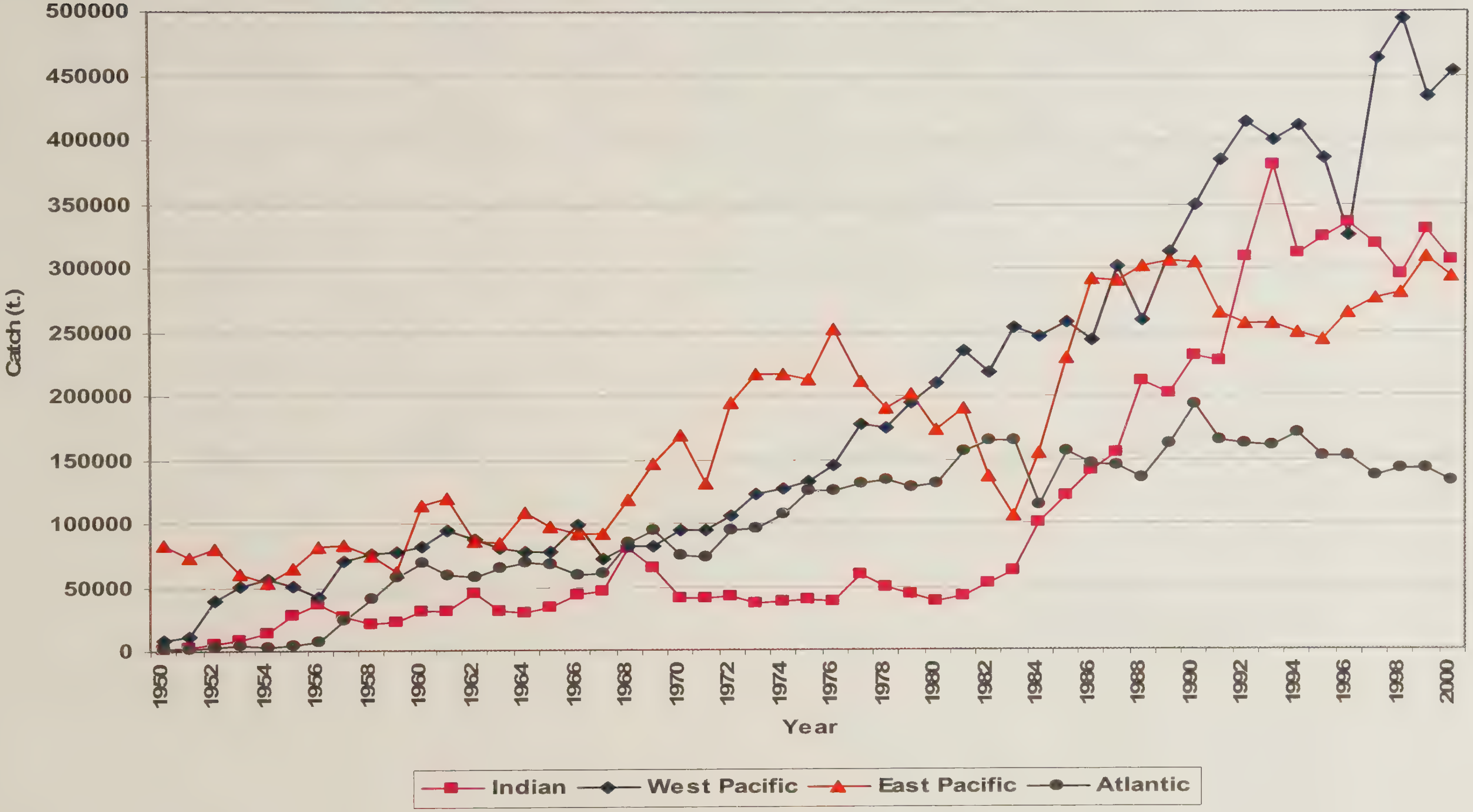

Figure 7: Annual catches of yellowfin tuna by area

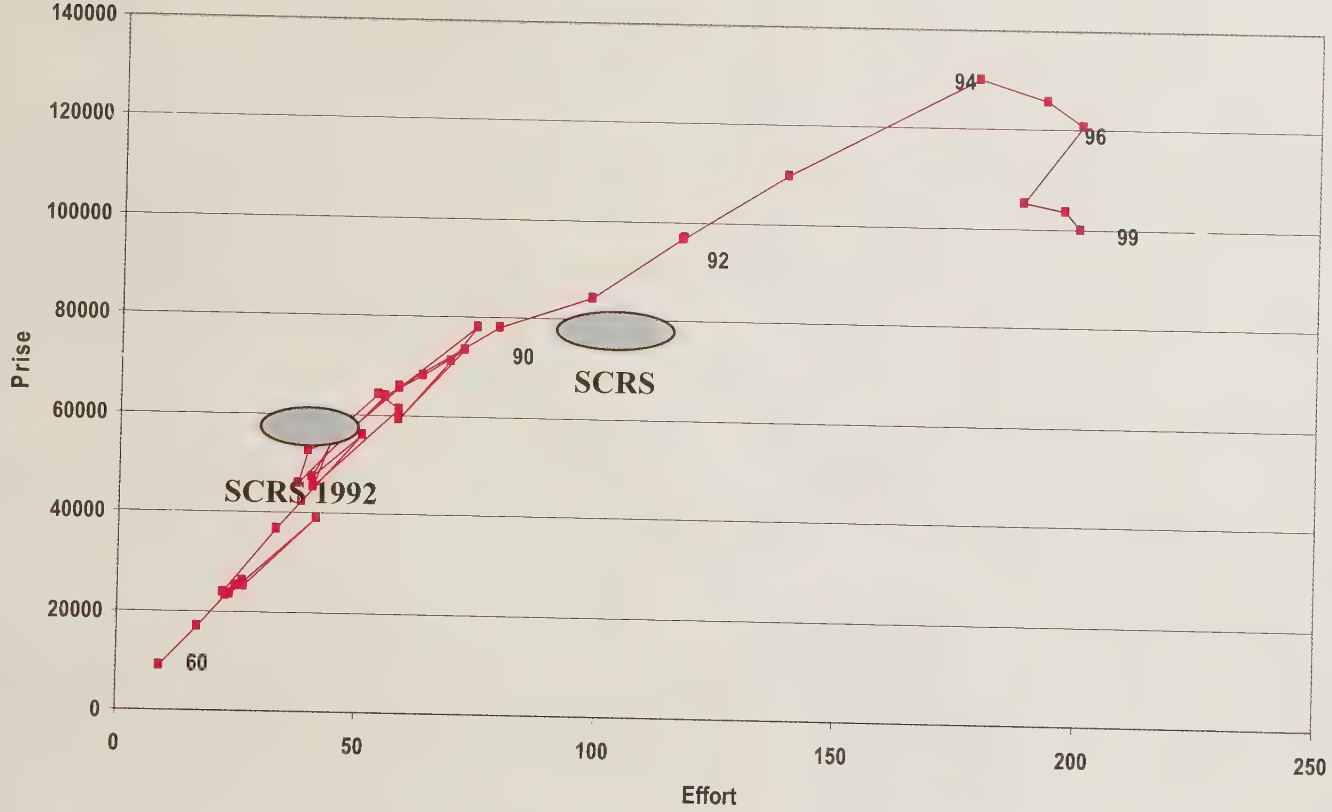

Figure 8: Catch and effort relationship observed for Atlantic bigeye. The MSY and optimal effort estimated by ICCAT in 1992 and in 2002 are also shown. It can also be noted that large increases of juveniles catches have been observed since 1992 and they should have produced a lower yield per recruit. Similar events were observed in the Pacific and Indian Oceans

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The multiple documents published yearly by the various tuna commissions and bodies (IATTC, ICCAT, IPTP, IOTTC, SCP, CCSBT) have been widely used to prepare this overview synthesis, but for practical reasons, they cannot be cited explicitly.

DISCUSSION PAPER 4

MANAGEMENT OF TUNA

by

Judith Swan[36]

Summary

The background of tuna management through regional tuna fishery management organizations (RTFMOs) is reviewed, acknowledging that, due to the highly migratory or mobile nature of tuna, management is best carried out throughout the range of the species, taking into account principles and provisions in recent international instruments. It is noted that while there has been a recent surge in development of national tuna management plans, activity has mainly been centred in the tuna-rich Pacific Island States of the Western and Central Pacific, in preparation for the establishment of the Western and Central Pacific Tuna Commission. General obstacles to management of tuna by RTFMOs are outlined, and issues and priorities for tuna management recently identified by the RTFMOs themselves presented, such as the need for more information and data, problems associated with IUU fishing and tuna trade. Steps being taken by RTFMOs to address specific management issues are described, including measures to implement recent international fishery instruments, develop catch certification and trade schemes and improve cooperation and coordination at regional level. Some paths to solutions were suggested, building on current initiatives and noting that this is a period of consolidation for the implementation of international instruments.

1. INTRODUCTION

1.1 International and regional considerations

The management of tuna, as highly migratory species, entered a new dimension with the adoption of the 1995 UN Fish Stocks Agreement. Building on elements of the 1982 UN Convention on the Law of the Sea ("1982 Convention"), 1993 FAO Compliance Agreement and the 1995 FAO Code of Conduct for Responsible Fishing, it provides an extensive framework for management objectives, cooperation and consultation, and enforcement of fisheries for highly migratory species, including tuna.

The 1982 UN Convention on the Law of the Sea ("1982 Convention"), Article 64, charges coastal States and other States whose nationals fish in the region for highly migratory species with cooperating directly or with international institutions with a view to promoting optimum utilization, within and beyond the exclusive economic zone (EEZ).

Species of tuna defined as "highly migratory" in Annex 1 of the 1982 Convention are:

- Albacore tuna: *Thunnus alalunga.*
- Bluefin tuna: *Thunnus thynnus.*
- Bigeye tuna: *Thunnus obesus.*
- Skipjack tuna: *Katsuwonus pelamis.*
- Yellowfin tuna: *Thunnus albacares.*
- Blackfin tuna: *Thunnus atlanticus.*
- Little tuna: *Euthynnus alletteratus; Euthynnus affinis.*
- Southern bluefin tuna: *Thunnus maccoyii.*

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[36] The views expressed in this paper are solely those of the author, Judith Swan, consultant, SwanSea@compuserve.com, swanjudith@yahoo.com

One rationale for promoting such cooperation is the fact that tuna range throughout areas of national jurisdiction of many States, as well as the high seas; hence, cooperative/consultative management would appear to benefit the species. In addition, a significant tuna industry lobby of the era, primarily in the United States, did not favour recognition of coastal State jurisdiction over tuna in order to maximize fishing opportunities, and promoted representation of industry interests by their national State in the management of tuna occurring in the waters of other coastal States. This could be achieved by membership of their State in a regional organization mandated with setting management measures throughout the range of the species, including EEZs of coastal States. However, the coastal States insisted on sovereign rights over all species, including tuna. There were two conflicting approaches to the application of Article 64.

To resolve this conflict, in the South Pacific region, the 1988 Treaty on Fisheries between the sixteen member States of the South Pacific Forum Fisheries Agency (FFA) and the United States was concluded and is still in force. This early instrument provided precedent for a cooperative approach to the management of highly migratory fish stocks, while preserving the sovereign rights of coastal States.

When the 1982 Convention was signed, there were already three regional organizations established with a mandate focused on tuna fish, and three more have been established since then. In addition, establishment of a Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean[37] is in preparatory stages. The organizations and date of establishment are as follows (see Annex 1 for details on the establishing instrument, membership and objectives of each).

- Inter-American Tropical Tuna Commission (IATTC), 1949;
- International Commission for the Conservation of Atlantic Tunas (ICCAT), 1966;
- South Pacific Forum Fisheries Agency (FFA), 1979;
- Western Indian Ocean Tuna Organization (WIOTO), 1991;
- Indian Ocean Tuna Commission (IOTC), 1993;
- Commission for the Conservation of Southern Bluefin Tuna (CCSBT), 1994.

Although its overall mandate is not focused on fish, or even tuna, the Secretariat of the Pacific Community (SPC), has carried out extensive research/technical programmes relating to tuna, and its work will be included in this paper.

The above bodies were established prior to the adoption of the UN Fish Stocks Agreement, but are actively engaged in implementing provisions of that instrument, as well as the other post-UNCED instruments, as noted in section 1.3.[38]

A new Commission will be established under the first post-1995 convention concluded implementing the UN Fish Stocks Agreement with respect to highly migratory fish stocks, the 2000 Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean ("WCPT Convention"). It is the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean ("WCPFC"). It seeks to ensure the conservation of stocks and, in particular, to ensure that stocks are not overexploited by uncontrolled high seas fishing. The WCPT Convention, once it enters into force, will enable limits to be imposed on the amount of fish that can be taken, and on who has access to the tuna resource.

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[37] Concluded pursuant to the 2000 Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, not yet entered into force.

[38] See Annex 3: while FFA noted that its mandate did not include fisheries management directly, it is indirectly implementing the instruments through, among other things, providing support and advice in establishing the WCPFC. Also note WIOTO activities will not be described in this paper. The organization was established prior to the establishment of IOTC, which has become the focus for regional tuna management in the Western Indian Ocean.

Because of these limits, access to the resource may become scarce and result in a substantial increase in the value of the resource.[39] Its key features include: a large geographical area to accommodate the entire migratory range of the stocks; a decision-making mechanism that includes a chambered voting system and conciliation procedure; binding dispute settlement; a Commission, Scientific Committee and Technical Committee; compliance and enforcement; and participation of Taiwan (Chinese Taipei).

The regional fishery bodies have been very active in addressing the issues in the post-UNCED international fishery instruments. A recent review was carried out by the author for FAO in respect of all regional fishery bodies (RFBs), including those noted above.[40] A questionnaire was distributed seeking information on: current issues of importance to the regional fishery body (RFB); implementation of post-UNCED international fishery instruments, including the four International Plans of Action (IPOAs); and action taken on the following specific issues: implementation of the precautionary approach; addressing ecosystem based fisheries management; assessment of the extent, impact and effects of IUU fishing in its area of competence; strengthening the RFB's capacity to deal more effectively with conservation and management issues; addressing issues relating to capacity; accommodating new entrants and catch certification and documentation.

Tables showing the responses of the tuna RFBs noted above appear in Annexes 2, 3 and 4 respectively. The responses will be analysed in section 2 of this paper, within the framework of the components of sustainability.

1.2 National activities

Tuna management by individual States has, in many cases, been enhanced by the 1995 Fish Stocks Agreement. For example, as part of the process to establish the WCPFC, Pacific Island States have been adopting Tuna Management Plans and revising their laws accordingly.[41] The US Pacific Fishery Management Council has developed a comprehensive Fishery Management Plan for Highly Migratory Species, with the lead goal being to "promote and actively contribute to international efforts for the long-term conservation and sustainable use of highly migratory species fisheries that are utilized by West Coast-based fishers, while recognizing these fishery resources contribute to the food supply, economy and health of the nation".[42]

Australia provides an example of a country that is developing two different rights-based approaches to managing tuna longline fleets for the west and east coast tuna longline fisheries. The west coast tuna fishery will be managed using a system of individual transferable catch quotas (ITQs), while the east coast will go the route of input controls, using limits on the numbers of branchline clips (hooks) to be used by each operator. These approaches are designed to meet the ecological sustainable development (ESD), economic efficiency and other legislative objectives that apply to both fisheries and were developed using extensive stakeholder consultation.[43]

Another approach is being taken in a major tuna fishing and consuming nation, Japan. An Organization for the Promotion of Responsible Tuna Fisheries (OPRT) representing all stakeholders in tuna fisheries[44] has recently been established,[45] with the objective of contributing to the responsible development of tuna fisheries and promoting sustainable use of tunas. Its first major project is to world towards the elimination of all flag of convenience tuna longline vessels carrying out illegal, unreported and unregulated (IUU) tuna fishing. To do this, it has a program to buy and scrap IUU vessels, and is working to ensure that tuna imports into Japan (the world's largest sashimi tuna market, 60 percent of which is imported) do not include fish from IUU vessels.[46]

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[39] See Aqorau, Transform, "The fisheries dynamics in the Western and Central Pacific Region; new opportunities" a working paper prepared for The FFA Rights Based Management Workshop held in Fiji 24-26 June 2002.

[40] See Swan, J, "Summary Information on the Role of International Fishery Organizations or Arrangements and other Bodies Concerned with the Conservation and Management of Living Aquatic Resources", FAO Fisheries Circular 985, FIPL/C985, 2003.

[41] For example, Solomon Islands, Federated States of Micronesia, Tonga, Palau, Vanuatu and Fiji have, among other States, been developing and adopting tuna management plans. Laws have been revised in Papua New Guinea, Cook Islands, Marshall Islands and Federated States of Micronesia, among others, to implement the instruments.

[42] See http://www.pcouncil.og/hms/draftfmp.html, for the September 2002 draft fishery management plan, adopted on 28 October 2002. It was to be submitted to the National Marine Fisheries Service in January, 2003.

[43] See Cartwright, Ian, "Rights-based fisheries management: the case of Australia", Working Paper prepared for the FFA Rights Based Management Workshop, Fiji, 24-26 June 2002.

[44] Including tuna fishing operators in the world, traders, distributors and consumers in Japan.

1.3 Rationale for regional focus in paper

While recognizing the broad scope of diverse national initiatives regarding tuna management, this paper will focus on the work of regional organizations as representative of tuna management. As evidenced in Annex 1, the membership of the regional tuna fishery bodies is wide-ranging, and their different mandates and collective decisions and actions represent ways of addressing factors of unsustainability and overexploitation in tuna fisheries.

In particular, the implementation by regional tuna fishery bodies of the international instruments reflects the priorities of their members' countries. Annex 3 shows that all bodies – with the exception of FFA which does not engage directly in fisheries management[47] – are taking steps to implement the 1993 FAO Compliance Agreement and the International Plan of Action on Illegal, Unreported and Unregulated Fishing ("IPOA-IUU fishing"). Most (four in each case) are taking steps to implement the 1995 UN Fish Stocks Agreement and 1995 FAO Code of Conduct for Responsible Fishing, as well as the IPOAs on the Conservation and Management of Sharks and the Management of Fishing Capacity. Only two report action to implement the IPOA on Reducing the Incidental Catch of Seabirds in Longline Fisheries.

Another compelling reason for focusing on regional management is the fact that tuna are highly migratory, and analysis from individual coastal State/fishing State-or-entity perspective can only provide a partial snapshot of management throughout the range. Regional bodies encounter the full range of obstacles and challenges in their management or related activities.

1.4 The Resource

There are four major tuna fishing areas in the world, shown in Figure 1: the Pacific Islands, the eastern Pacific (average annual tuna catches of about 525 000 mt), West Africa (385 000 mt), and the western Indian Ocean (450 000). The Pacific Islands fishery dwarfs the other three in volume (see graph) and because a large component of the catch is for the high value sashimi market, the relative value of the Pacific Islands tuna is even higher.[48] An Asian Development Bank Report noted that the value of tuna catch in the region increased from about US$ 375 million in 1982 to US$ 1.2 billion in 1993, US$ 1.6 billion in 1994, US$ 1.7 billion in 1995 and US $1.9 billion in 1998.[49]

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[45] OPRT was established on 8 December 2000.

[46] OPRT estimates that 20 000 tonnes of tunas harvested by IUU fishing vessel are imported into Japan annually, or about five percent of total imports.

[47] However, FFA is promoting and facilitating the implementation of the instruments for its member countries as appropriate.

[48] Almost one-third of all the tuna landed in the world comes from the Pacific Islands region, which supplies 60 per cent of all canned tuna and about 30 percent of the tuna for the Japanese sashimi market.

[49] Gillett, Robert *et al*, "Tuna, A Key Economic Resource in the Pacific Islands" A Report prepared for the Asian Development Bank and the Forum Fisheries Agency (Manila: Asian Development Bank, 2001).

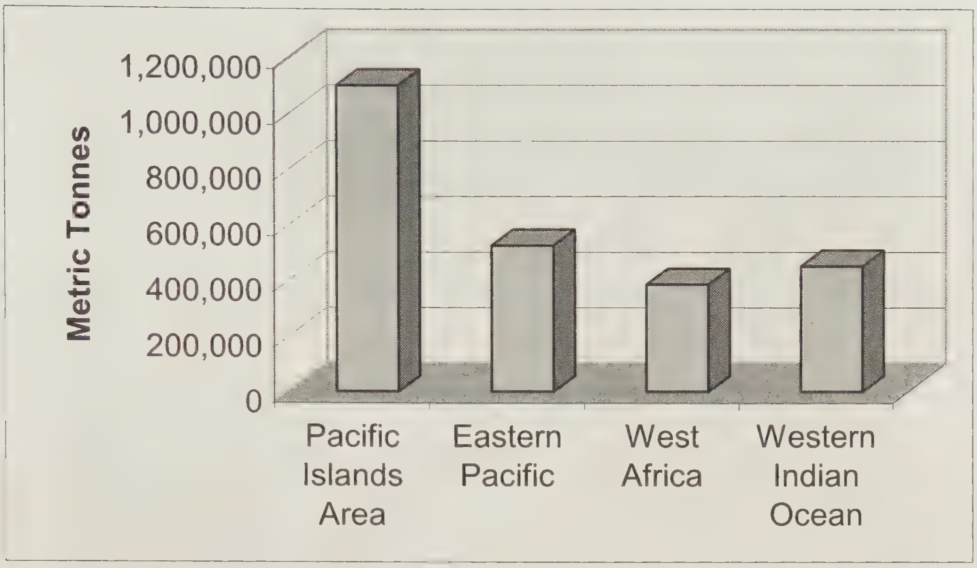
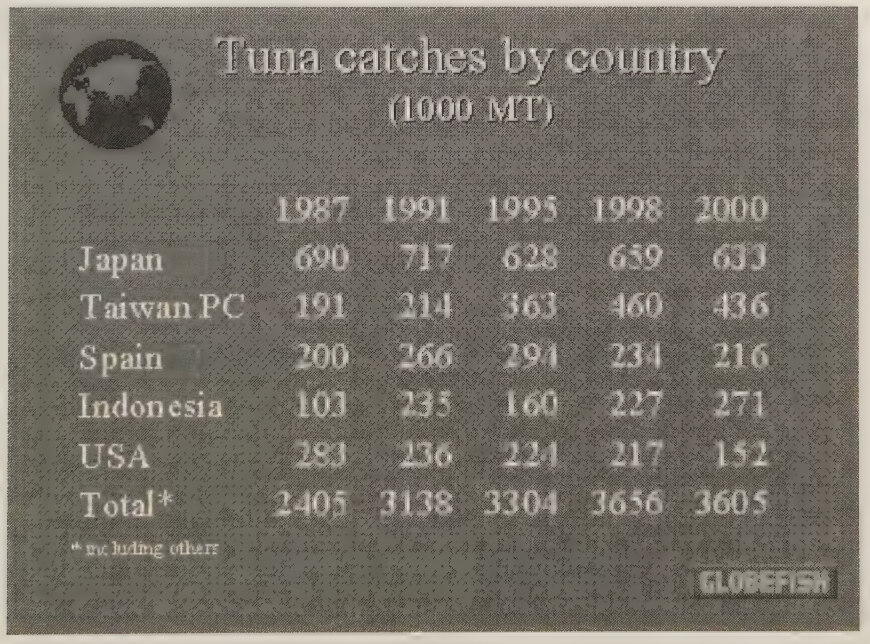


Figure 1. The World's Major Tuna Fishing Areas[50]

Industrial tuna fishing is carried out mainly by distant water fishing nations including China, Japan, Taipei (China), Spain, Indonesia and the United States, shown in Figure 2. Japan continues to be the world's major tuna catching country, but catches have contracted in recent years.[51]

Taiwan (Province of China) more than doubled its catch during the years under review from 190 000 MT to 460 000 MT in 1998, but also Taiwan (Province of China) experienced a decline in 2000. Noteworthy is the increase in tuna catch during the years under review of Indonesia (+130 percent). The loss of the tuna fishing grounds in the Central Eastern Pacific due to the tuna dolphin issue led to a substantial decline in US tuna production, down almost 50 percent



Tuna catches by country

(1000 MT)

	1987	1991	1995	1998	2000
Japan	690	717	628	659	633
Taiwan PC	191	214	363	460	436
Spain	200	266	294	234	216
Indonesia	103	235	160	227	271
USA	283	236	224	217	152
Total*	2405	3138	3304	3656	3605

* including others

GLOBEFISH

Figure 2. Tuna catches by country[52]

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[50] Gillett, Robert "A Review of the Fisheries of the Pacific Islands Area, FAO Statistical Area 71 and 77", August 2001.

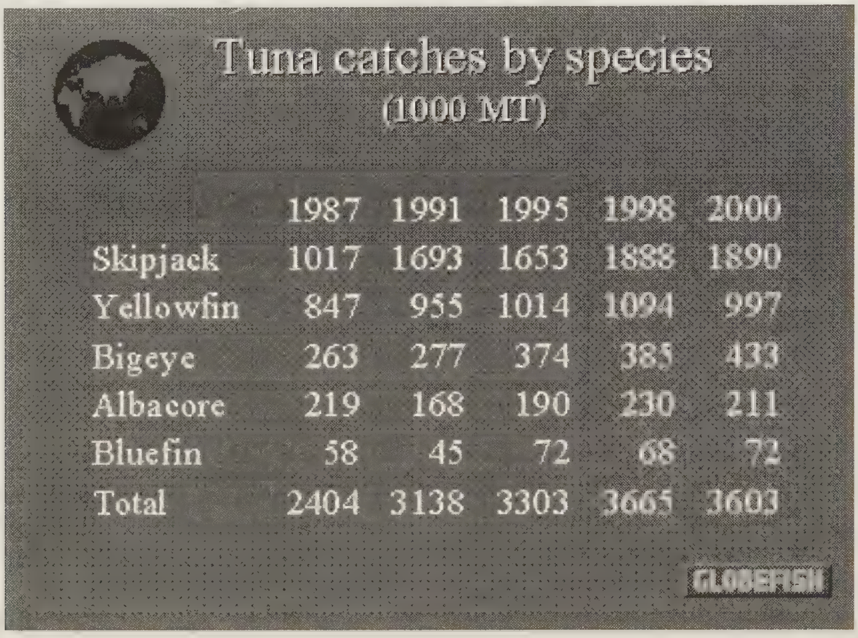
[51] In 2000, Japanese tuna production was 633 000 MT, which compares to a peak of 780 000 MT in 1986 and 1993

[52] http://www.globefish.org/presentations/Tuna%20markets/slide4.htm

Figure 3. shows that skipjack is by far the main species caught, and catches increased by 80 percent over the past decade. In 1999, skipjack catches reached a peak of almost two million MT.

Yellowfin is the second major species, also growing, but at a slower path than skipjack. This species is generally higher priced than skipjack, also used in canning. In 2000, yellowfin catches declined by ten percent over 1999 to about one million MT.

Albacore catches were stable over the years, while bigeye catches went up. For bigeye there is concern about over-fishing.



Tuna catches by species
(1000 MT)

	1987	1991	1995	1998	2000
Skipjack	1017	1693	1653	1888	1890
Yellowfin	847	955	1014	1094	997
Bigeye	263	277	374	385	433
Albacore	219	168	190	230	211
Bluefin	58	45	72	68	72
Total	2404	3138	3303	3665	3603

Figure 3. Tuna Catches by Species[53]

The graph in Figure 4. compares the growth in tuna catch (in quantity terms) with the growth of tuna exports (expressed in value terms). It can be noted that trade expanded more than catch, reflecting increase in value of both fresh and frozen tuna in recent years. It has to noted, however, that the trade figures have not been adjusted for inflation. In 1999, the oversupply of tuna shows that while catches reached a record of 3.8 million MT, the total value of tuna trade was lower than in 1998 or 2000.

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[53] http://www.globefish.org/presentations/Tuna%20markets/slide5.htm.

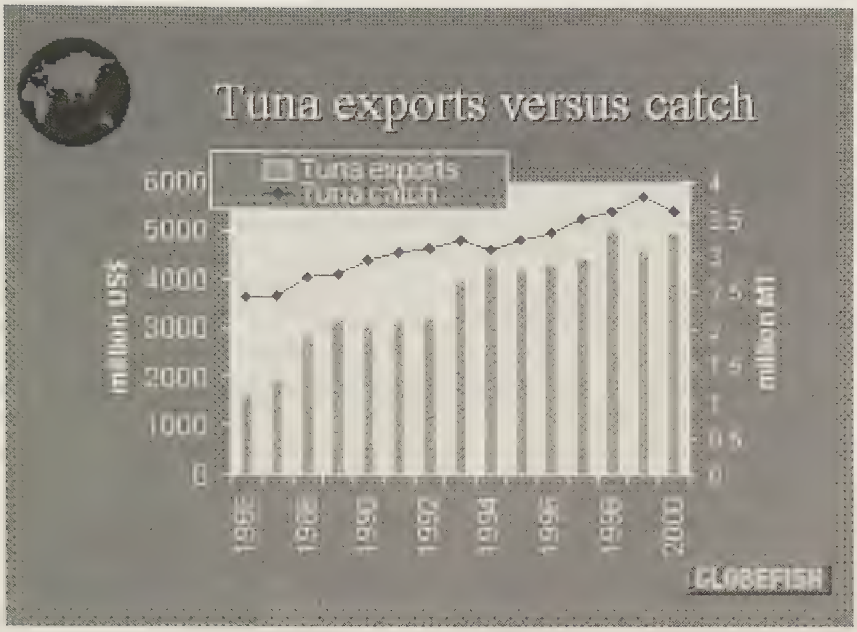
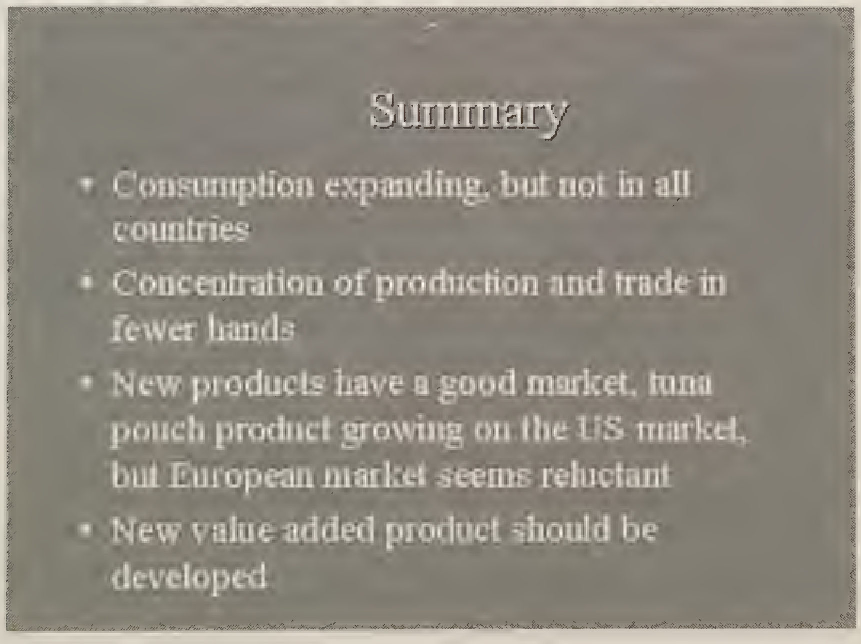


Figure 4. Tuna exports versus catch.[54]



Summary

- Consumption expanding, but not in all countries
- Concentration of production and trade in fewer hands
- New products have a good market, tuna pouch product growing on the US market, but European market seems reluctant
- New value added product should be developed

Figure 5 – Summary and Outlook[55]

The biological aspects of the fishery are thoroughly reviewed in Dr Fonteneau's paper in this document. In more general terms, Figure 5. indicates that catch reduction has been successful, but the source, GLOBEFISH, does not provide such scientific details. However, it also indicates that bluefin and bigeye are under stress. This is reinforced by scientific advice provided to regional fisheries management organizations. For example, the Scientific Committee of the CCSBT advised in October 2002 that at a global catch of about 15 500 tonnes there was an equal probability that the bluefin stock could decline or improve. It was acknowledged that at current catch levels there is little chance that spawning stock will be rebuilt to the 1980 levels by 2020.[56]

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[54] http://www.globefish.org/presentations/Tuna%20markets/slide7.htm

[55] http://www.globefish.org/presentations/Tuna%20markets/slide8.htm.

A report of the Oceanic Fisheries Programme at the SPC[57] notes in respect of bigeye tuna in the western and central Pacific Ocean that biomass in the 1990s is estimated at approximately 35 percent below the level it would have been if fishing had never occurred. It concludes that overfishing has not yet occurred, but notes as a continuing concern that a significant part of the increase is attributable to the Philippines and Indonesian purse seine fisheries, which have the weakest size, effort and catch data. In the eastern Pacific, the IATTC assesses the status annually and has adopted quotas and restrictions on floating objects, and the Pacific Fishery Management Council reports that the stock in the eastern Pacific appears to be near the level that produces MSY. [58] However, there is concern over increased fishing on juveniles since the advent of the expanded fishery targeting tuna by sets on floating objects.

It should be noted that other tuna resources had been under stress prior to the initiatives at regional and international level to ban or place a moratorium on driftnet fishing. The 1989 Wellington Convention on driftnet fishing was agreed in direct response to a rapid build-up of the driftnet fishing fleet[59] for southern albacore tuna. Scientific advice indicated that if fishing were to continue at existing levels, the stock would be threatened with collapse within two years.

2. IS FISHERY MANAGEMENT SUCCESSFULLY ACHIEVING THE FOUR COMPONENTS OF SUSTAINABILITY?

2.1 Relevant background - regional organizations

The framework for this paper seeks an evaluation as to whether the fishery management organization “understands” the aims of the various components of sustainability: bio-ecological, social, economic and institutional. In the case of regional fishery bodies, there may be an understanding of what their aims should be, but their mandate may limit their actions in fulfilling the aims. In one case – the IATTC – this has been recognized and the Convention is being renegotiated to strengthen the conservation and management program. In another - the IOTC – it is observed that although the 1995 UN Fish Stocks Agreement may encourage some non-members to accede, the Commission is not mandated by all its members to pursue implementation.[60] The latter indicates issues such as industry pressure, lack of political will or other factors may be operating to discourage steps to implement the Agreements.

There are a range of problems that RFBs with management mandates share, including the regional tuna management organizations. These are noted below under the various components of sustainability, but in general concern is shared in relation to issues such as: membership/participation in the management regime may not include all fishing States or entities; difficulties/inability of members to agree on management measures; reporting/data collection/research a problem from members (and non members); weak implementation of decisions; difficulties to implement controls at sea or in ports; inability to inspect landings and enforce/prosecute; divergent interests of coastal and fishing States; and no exhaustive list of registered vessels.

It is in this context that the main objectives and activities of each RFB will be described, before reviewing the activities under each of the four components. The aims and actions of each body can therefore be better understood.

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[56] http://www.ccsbt.org/docs/management.html.
[57] Hampton, 2002.
[58] See note 5, above.
[59] Comprised of vessels from Korea, Taiwan and Japan.
[60] Swan, *op. cit.* note 4.

CCSBT The objective of the Convention is to ensure, through appropriate management, the conservation and optimum utilization of southern bluefin tuna (SBT). The functions of the Commission include: (i) collecting, analysing and interpreting scientific and other relevant information on SBT, and (ii) adopting conservation and management measures including the total allowable catch and its allocation among the Members. Other additional measures may also be adopted by the CCSBT. The species covered by the Convention is SBT, and the Commission is also responsible for collecting information on "ecologically related species" defined in the Convention as living marine species which are associated with southern bluefin tuna, including but not restricted to both predators and prey of SBT.

FFA The objectives of the Convention are: (i) conservation and optimum utilization of the species covered by the Convention; (ii) promotion of regional cooperation and coordination in respect of fisheries policies; (iii) securing of maximum benefits from the living resources of the region for their peoples and for the region as a whole and in particular the developing countries; and (iv) facilitating the collection, analysis, evaluation and dissemination of relevant statistical scientific and economic information about the resources covered by the Convention. The functions of the Agency include, *inter alia*: (i) harmonization of policies with respect to fisheries management; (ii) cooperation in respect of relations with distant water fishing countries; (iii) cooperation in surveillance and enforcement; (iv) cooperation in respect of onshore fish processing; (v) cooperation in marketing; (vi) cooperation in respect of access to the 200 mile zones of other Parties. The species covered by the FFA are the highly migratory species of tunas, primarily skipjack, yellowfin, bigeye and albacore.

IATTC The main objectives of the Convention are to maintain the populations of yellowfin and skipjack tuna and other kind of fish taken by tuna fishing vessels in the eastern Pacific and to cooperate in the gathering and interpretation of factual information to facilitate maintaining the populations of these fishes at a level which permits maximum sustainable catches year after year. The functions of the Commission include *inter alia* (a) to gather and interpret information on tuna, (b) to conduct scientific investigation concerning the abundance, biology, biometry, and ecology of yellowfin and skipjack tuna in the Convention Area, and to recommend proposals for joint action for conservation. The Commission has regulatory powers and catch quotas for yellowfin tuna have been set by the Commission since 1962. Since 1976, the Commission has implemented a programme on tuna dolphin relationship and since 1992 it has developed an International Dolphin Conservation Programme aiming at progressively reducing dolphin mortality in tuna fishing. The Commission also serves as the Secretariat for the Agreement on the International Dolphin Conservation Program, whose principal objective is to reduce and strictly regulate accidental dolphin mortality which occurs in the purse seine fisheries for tuna. The species covered by IATTC are all tunas and other fish taken by tuna fishing vessels.

ICCAT The main objective of the Convention is to maintain the populations of tuna and tuna-like species found in the Atlantic at levels which permit the maximum sustainable catch for food and other purposes. The Commission's functions *inter alia* include: (i) to study the populations of tuna and tuna-like fishes, (ii) to collect and analyse statistical information relating to the current conditions and trends of the tuna fishery resources of the Convention Area, and (iii) recommend studies and investigations to the Contracting Parties.

The species covered by the Commission are the tuna and tuna-like fishes (the *Scombrioformes* with the exception of the families *Trichiuridae* and *Gempylidae* and the genus *Scomber*) and such other species of fishes exploited in tuna fishing in the Convention Area as are not under investigation by another international organization. The Commission has no regulatory powers, but makes regulatory recommendations to be implemented by Contracting Parties, but these are subject to an objection procedure. ICCAT has recommended a number of measures on catch quotas, minimum weight of fish and limitation of incidental catches, as well as IUU fishing.

IOTC The main objectives of the Agreement are to promote cooperation among members with a view to ensuring through appropriate management, the conservation and optimum utilization of stocks as well as to encourage sustainable development of fisheries based on them. The Commission may be a two-third majority of the Members present and voting adopt conservation and management measures binding on its Members. Such regulatory measures are subject to objection procedure. The species covered by the Convention are as follows: yellowfin tuna, skipjack tuna, bigeye tuna, albacore, Southern bluefin tuna, longtail tuna, kawakawa, frigate tuna, bullet tuna, narrow-barred Spanish mackerel, Indo-Pacific king mackerel, Indo-Pacific blue marlin, black marlin, striped marlin, Indo-Pacific sailfish, and swordfish.

SPC The main objective of the Agreement is to encourage and strengthen international cooperation in promoting the economic and social welfare and advancement of the peoples of the South Pacific region. The Divisional goal for fisheries is to provide a regional service which provides information, advice and direct assistance to the Pacific Community through SPC member governments, either individually or collectively, in using living marine resources in the most productive and responsible manner possible. Activities include fisheries stock assessment (for both reef fisheries and highly migratory fish stocks), marine ecosystem research for reef and pelagic fisheries, small scale tuna fisheries development support, coastal fisheries management support and fisheries information and databases within the area of competence.

The Commission operates a Coastal Fisheries Programme covering all living aquatic species subject to subsistence and commercial fishing and aquaculture, and an Oceanic Fisheries Programme which deals with tuna, billfish and related species. The goals and objectives are described below.

Coastal Fisheries Programme

The goal is to optimise long-term social and economic value of small-scale fisheries and aquatic living resource use in Pacific Island waters, with the following objectives:

- a regional support framework for economically, socially and environmentally sustainable aquaculture planning, research and development by Pacific Island governments and private enterprises;
- economically-viable and environmentally sound Pacific Island fishing enterprises;
- environmentally sound and socio-economically achievable governance of reef and lagoon fisheries;
- fishing sector human resource and technical skills development;
- scientifically rigorous information on the status, exploitation levels and prospects of the coastal resources managed by Pacific Islanders; and
- easily-available, relevant and understandable aquatic living resource-based knowledge for member countries and territories.

Oceanic Fisheries Programme

The goal is to provide access to Pacific Island countries and territories (PICT) of the best available scientific information and evidence necessary to rationally manage fisheries exploiting the region's resources of tuna, billfish and related species, with the following objectives:

- comprehensive regular assessments of status and prospects of oceanic fisheries for Pacific Island Countries and Territories (PICT) fisheries departments and regional processes;
- oceanic fishery data collection and analytical support to PICT fisheries departments; and
- understanding pelagic ecosystems in relation to tuna and associated species stocks.

Information included under each component below is sourced from the responses of the secretariats of the RFBs to the recent survey carried out for FAO.[61] It is emphasized that the member countries did not formally consider the responses, which are to be understood only as indicative of trends in tuna management. In addition, the information may be incomplete, as it is based on the questions and responses, rather than a comprehensive analysis of documents and activities of each RFB. However, it does provide useful insights in relation to the issues in this paper. The information is presented in three parts under each:

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[61] Swan, *op. cit.* note 4.

Indicative issues important to the RFBs: The RFB Secretariats were requested to identify the five most important issues for them, and the reasons why they are important. If an RFB did not indicate an issue as a priority, this does not necessarily mean the issue is unimportant for the RFB. A summary of the issues identified by the RFBs appears in Annex 2.

Implementation of Post-UNCED international fisheries instruments: Respondents were requested to provide information regarding recent activities, priorities or plans to implement the post-UNCED international fishery instruments.[62] A summary appears in Annex 3.

Addressing specific issues: Respondents were requested to indicate if their RFB has recently undertaken any activity, priorities or plans in relation to certain issues described in section 1.1. A summary of the specific issues and responses appears in Annex 4.

2.2 Bio-ecological Component

The bio-ecological component of sustainability embraces the aim to protect, conserve and restore fishery resources, the environment, habitat and ecosystem and biodiversity. It includes the prevention of overfishing and the restoration of resources, habitats and ecosystems to conditions capable of producing maximum sustainable yield (MSY), taking into account multispecies and ecosystem considerations.[63]

2.2.1 *Priority Issues for RFBs*

Priority bio-ecological issues identified by three RFBs are implementing responsible fisheries management and two identified applying the ecosystem approach to fisheries management and by-catch issues. This mirrors the trend in the main study, and is consistent with prominent issues in recent international instruments, which in turn responded to broad international concern.

Regarding responsible fisheries management, this would include establishing management measures for sustainable fisheries including TACS, and effort control and other measures.
CCSBT referred to the fact that the southern bluefin tuna (SBT) stock has been fished to low historical levels, and the consequent importance of setting a TAC for its management and conservation objectives.

IOTC noted difficulties in the allocation of resources, and the need to determine principles for that purpose. Its Agreement guarantees a share to coastal States and DWFNs invoke historical rights based on past exploitation levels or capacity. This issue is complicated by reflagging of IUU fleets in non-coastal States, often with open registries, some of which are seeking contracting or cooperating status in the Commission. IOTC also noted that a substantial part of the catch is unreported.

Ecosystem issues are addressed by ICCAT, which has added ecosystem issues to its agenda to monitor developments for management purposes. SPC noted the need to understand the broader large marine ecosystem supporting the managed species, and links this with the hitherto lack of detailed information on the potential significance of tuna fishery by-catch. IATTC has also noted the need to control by-catch.

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[62] 1993 FAO Compliance Agreement, 1995 UN Fish Stocks Agreement, 1995 FAO Code of Conduct for Responsible Fisheries and the four International Plans of Action, on Reducing the Incidental Catch of Seabirds in Longline Fisheries, the Conservation and Management of Sharks, the Management of Fishing Capacity and the Prevention, Deterrence and Elimination of IUU Fishing.

[63] To some extent this overlaps with the institutional component of sustainability, especially in relation to the prevention of overfishing as this must be achieved through scientific information, monitoring control and surveillance (MCS) and other means. Activities such as IUU fishing will therefore be addressed under the institutional component.

2.2.2 Implementation of post-UNCED International Fishery Instruments

This section addresses implementation of the three main instruments – the Compliance Agreement, Fish Stocks Agreement and Code of Conduct – and the species-related IPOAs (incidental catch of seabirds, management of sharks).

The CCSBT is taking account of all post-UNCED fishery instruments in the implementation of its management and conservation objectives, as noted in this and the other components as described below. Activities in this regard relating to the bio-ecological component include:

- fishing activity is being managed at levels consistent with the scientific advice;
- the CCSBT has a working group focusing on ecologically related species and has taken decisions to require members to fish responsibly; and

The post-UNCED fishery instruments are not directly relevant to FFA, because it does not have a mandate to adopt conservation and management measures and therefore is not a management organization. However, the instruments are relevant to members' national activities and legislation, and to the WPTC. FFA's role is to assist its member countries as noted above and in the work of the Commission.

To implement the 1993 FAO Compliance Agreement, The IATTC Commission has developed a regional register that lists vessels that are authorized to fish in the area of the Agreement. It has also agreed to establish a list of vessels that are not authorized to fish in the area of the Agreement and are undermining the Agreement and the conservation and management measures.

Currently IATTC members are negotiating a new Convention that will take into account, among other things, many of the relevant principles of the 1995 UN Fish Stocks Agreement. Only two members of the IATTC have ratified the Agreement, but many of the key provisions of the Agreement have been incorporated into the draft negotiating text for the new Convention.

The IATTC has not adopted specific measures to promote the application of the 1995 Code of Conduct for Responsible Fisheries. However, the relevant portions of the Code of Conduct often serve as a guideline for the consideration of the Commission's conservation and management resolutions, and most, if not all, of the resolutions adopted by the parties to the IATTC are drafted in accordance with the principles of the Code.

Regarding the IPOA on the Conservation and Management of Sharks, the IATTC has adopted a measure requiring purse seine vessels to promptly release unharmed, to the extent practicable, all sharks taken incidentally. The Commission has also taken action to enhance the collection of shark by-catch information.

ICCAT indicates its implementation of the post-UNCED fishery instruments by including post-UNCED fishery agreements on its website. The number of resolutions and recommendations adopted annually by ICCAT has increased dramatically over the past decade. Many of these support the post-UNCED Fishery Instruments.

Regarding the 1993 FAO Compliance Agreement, the IOTC Secretariat is collecting data on all tuna fishing vessels in the Indian Ocean and coordinating this activity with FAO and the other tuna regional fisheries management bodies.

Although the 1995 UN Fish Stocks Agreement may encourage some non-members to accede to IOTC, the Commission is not mandated by all its members to pursue implementation.

The IPOA on Reducing the Incidental Catch of Seabirds in Longline Fisheries is only an issue in the temperate zone, where IOTC recognises the priority of CCSBT in the management of southern bluefin tuna.

Regarding the IPOA on the Conservation and Management of Sharks, the IOTC Commission has authorised the Secretariat to collect statistical data on non-target, associated and dependent species, including sharks. This does not go the extent of conducting stock assessment because the Agreement provides a mandate on only 16 tuna and tuna-like species.

The SPC supports its members extensively in the implementation of the 1995 FAO Code of Conduct for Responsible Fisheries, including dealing with small-scale fisheries and aquaculture.

Some assessments and observer data analyses, have been carried out on incidental seabird catch, and it was recognised that this is not a problem in the current fisheries within the SPC mandate area.

SPC is undertaking some assessments on the conservation and management of sharks, based on observer data and improvement of by-catch reporting by fishing fleets. Current indications are that Pacific pelagic shark catches are within sustainable limits. SPC

SPC's focus will be also on some other more fragile by-catch species, including turtle. Awareness materials have been produced on the general by-catch issue (including sharks), and one of the main aims of the SPC Fisheries Development Section is to promote tuna fishing methods by Pacific Islanders that mitigate by-catch.

The SPC's mandate does not extend to managing fishing capacity or implementing the Compliance Agreement.

2.2.3 Addressing Specific Issues

The IATTC has addressed the matter of ecosystem-based fisheries management in the formulation of relevant conservation and management measures. Thus, in considering measures for yellowfin and bigeye tuna, the two principal species currently being managed by the Commission, the impact on all species of tuna in the same ecosystem is taken into account. Further, the Commission has adopted resolutions regarding by-catch that are designed to address ecosystem management by requiring specific measures to reduce the by-catch of species taken in the tuna purse seine fisheries. This has included the development of ecosystems models for the eastern tropical Pacific Ocean.

Also, IATTC members are currently negotiating a new Convention which will strengthen further the conservation and management program.

SPC's work is oriented towards ecosystem-based fisheries management in the context of the Oceanic Fisheries Programme on ecosystem understanding, supported by the EU and GEF, and of the reef fisheries work.

2.3 Social component

The main social aims of sustainability are to achieve optimum utilization of the resource, ensure safe, healthy and fair working environments and conditions, consider aquaculture as a means to promote diversification of income and diet and assist developing countries.

Most of the regional tuna organizations are not specifically mandated to achieve these aims. However, in the Western Central Pacific the technical work of the SPC does include aquaculture and obtaining information on subsistence village "IUU fishing". The need to guide increasing aquaculture investment into economically and socially sustainable channels was cited by SPC.

SPC also referred to assisting member States with the change in balance between subsistence and commercial fisheries. In this regard, an attendant need was identified to develop environmentally sound small scale coastal-based fishing enterprises, working in collaboration with the larger-scale tuna fisheries economic development work of FFA.

FFA cited tuna industry development and conflict management between artisanal and industrial fisheries as current issues. In relation to the former, FFA reported that its members are determined to see more private sector tuna-based economic activities, and to improve their domestic retention of economic and social benefits from the tuna industry. FFA will assist this by providing or coordinating expert advice in particular areas of interest.

Assistance to developing countries is high on the agenda of the organizations whose membership is comprised of developing countries. FFA and IOTC referred to a need for capacity building and financial support for fisheries administration in their member States.

2.4 Economic Component

The main economic aims are to match fishing capacity to the productive capacity of the resources, the environment and the ecosystem, to conduct trade according to World Trade Organization rules, including the elimination of subsidies, and to prevent illegally caught fish from reaching their markets.

2.4.1 Priority Issues for RFBs

Increasing fishing capacity of the fleets was cited by IATTC as a priority issue, which noted that the fleet should be controlled for reasons of conservation.

While prevention of illegally caught fish from reaching their markets is important for some bodies, it is discussed in the context of IUU fishing under section 2.5.

2.4.2 Implementation of post-UNCED International Fishery Instruments

In relation to the IPOA on the Management of Fishing Capacity,

The members of the IATTC Commission reached agreement in June of 2002 on the limitation of fishing capacity in the Eastern Pacific Ocean (EPO). The Commission has established a Permanent Working Group on Fleet Capacity and is considering a draft Plan of Action on the management of fishing capacity for the EPO.

Resolutions have been taken by IOTC to prevent capacity increase in certain targeted stocks. There have also been repeated calls for fleet reductions. The Secretariat is collecting data on all tuna fishing vessels in the Indian Ocean.

2.4.3 *Addressing Specific Issues*

A comprehensive trade information scheme is in place in CCSBT member countries. The IATTC is currently considering the adoption of a catch certification and documentation scheme for Bigeye Tuna

Regarding fleet capacity issues,

- the CCSBT uses voluntary quotas but individual members have reduced capacity to assist with the containment of catch to such quotas;
- the IATTC has established a Permanent Working Group on Fleet Capacity and consideration of a draft Plan of Action on the management of fishing capacity for the EPO.
- assessment of effort by IOTC is addressed actively as a complement to vessel listings.

- SPC advises countries during the course of developing national fishery development strategies, with the underlying philosophy that capacity should be incremented gradually. Further, SPC advises that actual fishing mortality should be reassessed after every new increment of fleet capacity, in relation to estimated sustainable limits. This is the preferred alternative to approving as many licences as possible, assessing the impact and then realizing that cut-backs are necessary; it promotes both sustainable local industry development and conservation. SPC does not certify catches, but monitors them as much as possible through the SPC Pacific Islands-based Port Sampling Programme.

2.5 Institutional Component

The main institutional aims are to use the best scientific information in a range of contexts, apply the precautionary approach, MCS both in-zone and on the high seas; cooperate with States and RFMOs to promote conservation and responsible fishing and resolve disputes peacefully, implement decision making processes and involve interested parties, education and training, and to take account of multiple use of coastal areas.

2.5.1 Priority Issues for RFBs

IUU fishing was named by a number of RFBs as an important issue. Concern was expressed about the level of unreported catches[64] and extent and impact of IUU fishing.[65] One RFB attributes the unreporting in its area of competence to the fact that the vessels concerned are flagged in open registry countries.[66]

Conflicts of interest at national level are a problem stated by one RFB.[67] Conflicts between the industry/environmental interest groups at national level leads to a reluctance to take specific management measures, although the principle behind these measures might have been adopted through ratification of overarching international instruments. It may also lead to a reluctance to monitor compliance through third party VMS or observer coverage.

For science-related issues, RFBs centred their responses around practical issues, including the need for continuing, accurate, comprehensive stock assessments.[68] Some RFBs were concerned about statistical databases. They pointed to the need for timely statistics and submission, collection and distribution of information.[69] One RFB focused on the need for a general Scientific Research Programme.[70]

On institutional issues, for one RFB the work begins at home; the important issue was reported as fostering solidarity, political will and cooperation among members.[71] Some RFBs identified related financially-based issues, the need for capacity building/financial support for fisheries administrations in member States.[72]

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[64] IOTC noted that a substantial part of the catch is unreported.

[65] CCSBT noted that the southern bluefin tuna (SBT) stock has been fished to low historical levels. Scientific advice to the CCSBT is that at current catch levels there is a 50 percent chance of decline in the stock and a 50 percent chance of recovery. In this context it is believed that any fishing outside the membership of the CCSBT could be critical.

[66] IOTC.

[67] IOTC.

[68] SPC cited the need to mitigate scarcity of information on reef fisheries and supporting ecosystems. CCSBT reported that SBT have a biology with important implications for management by the CCSBT. Age at maturity is no less than eight years, life expectancy is up to 40 years, there is only one known breeding ground and the spatial distribution of the fish is not well understood. An accurate assessment of the stock in this context is very important for the Commission. and hence legislate the minimum mesh size for exploitation.

[69] SPC referred to the need for better statistics on tuna fishery, by-catch and effort by DWFNs and coastal States fishing in the region. IOTC deals with aggregated data provided by the Flag State. Many countries, including some DWFNs, do not have adequate statistical systems. The Secretariat therefore has to employ considerable resources to upgrade these systems. The Commission has also determined minimum data standards, but it has proved difficult to obtain finer-level data needed for some stock assessment studies. .

[70] CCSBT referred to the fact that circumstances surrounding stock assessment for SBT require sound scientific advice. The CCSBT has begun the implementation of a scientific research program aimed at supporting the stock assessment process.

[71] FFA reported that the need for FFA members to maintain solidarity on resource management issues in response to internal and external pressures is well recognized. While regional solidarity is primarily a concern for the members, the Agency will

Linked to the financial and capacity issues is human resource development. One RFB is concerned about the need to develop a specialized human resource cadre in fisheries in member States to lessen the reliance on international and regional assistance, and to fulfil their own stewardship obligations in areas where there is no international or regional assistance.[73]

Another area of concern is information and communication. Information exchange among member States, between the member States and the organization,[74] its communication to decision-makers[75]

Some RFBs cited membership concerns as an important issue for them. This includes fishing by non-members,[76] and broadened participation in the RFB.[77] One identified renegotiation[78] of a Convention as important.

2.5.2 Implementation of post-UNCED International Fishery Instruments

The CCSBT is taking account of all post-UNCED fishery instruments in the implementation of its management and conservation objectives. Activities in this regard include the following.

- expert scientific advice is collected to inform decision making;
- fishing activity is being managed at levels consistent with the scientific advice;
- IUU fishing has been targeted and appears to have been affected significantly by the CCSBT trade information scheme;
- publicity material is being prepared to educate SBT fishers about sharks and seabirds associated with the fishery.

The IATTC has taken measures in order to combat IUU fishing in the Eastern Pacific Oceans (EPO), such as developing a Regional Register of vessels that are authorized to fish for species under the purview of the Commission, establishing a permanent working group to deal with IUU fishing on a regular basis, and the adoption of resolutions, intended to discourage IUU fishing, regarding fishing by non-parties. The Commission recently agreed to develop a list of non-cooperating vessels, and is in the process of preparing such a list.

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foster solidarity by ensuring that its services to members are undertaken on an equitable basis. Advisory and negotiating briefs will promote common positions and uniform approaches.

[72] IOTC referred specifically to the need to improve statistical systems in some Contracting Parties to meet the agreed minimum data standards. The majority of FFA member States have small populations, fragile economies, and limited technical capacity and expertise. On the other hand the tuna resources of their exclusive economic zones and in the region generally are vast and constitute one of the largest fisheries in the world. FFA has been given the role of assisting members in improving their capacity to manage and develop the tuna resources for their benefit.

[73] SPC.

[74] FFA reported that one of the important challenges is provision of information amongst FFA members, and between members and the Agency. FFA will take a role in facilitating information exchange by promoting website use and other modern/efficient communication methods, by producing timely publications, and by arranging meetings of members and others on critical topics.

[75] SPC cited the need to get better information on all areas to decision-makers. A need was stated for an expert filter to process and summarise relevant and applicable information from the vast flow of material, not all of it relevant, that fisheries administrations currently access.

[76] CCSBT reported that there are currently five members of the Extended Commission which cover about 90 percent of the reported catch. Indonesia fishes in the only known spawning ground of SBT and takes a significant amount of SBT. The CCSBT is encouraging the membership of Indonesia, in particular, and other interested countries to join so that the aims and objectives of the Convention will apply to almost the full commercial catch of SBT.

[77] IOTC noted that key fishery participants are not currently parties to the Commission. One has withheld important data against a voice in management decisions and access to the resource and another is concerned about having to apply management measures to their artisanal fishery.

[78] IATTC referred to the importance of updating and improving the existing Convention in order to make it more effective. This is also an opportunity to apply the new fisheries management principles that have been recently negotiated.

ICCAT adopted a Resolution adopted at its Ninth Special Meeting (Madrid, November-December, 1994), Regarding the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, which states that the Contracting Parties should take the necessary measures as soon as possible to maintain a register of all high seas fishing vessels greater than 24 meters in length and provide ICCAT with this information annually. ICCAT encourages non-Contracting parties to do the same. In 1999, ICCAT published a list of around 340 longline tuna fishing vessels claimed to be involved in IUU fishing and flagged to countries operating open registers.

The ICCAT Resolution Concerning the Unreported and Unregulated Catches of Tunas by Large-Scale Longline Vessels in the Convention Area adopted at the 11th Special Meeting in Spain, 1998 requires the Commission to request the Contracting Parties, Cooperating Parties, entities or fishing entities which import or land frozen tuna and tuna-like products to submit specified information on an annual basis. The Compliance Committee and Permanent Working Group for the Improvement of ICCAT Statistics must then identify those whose vessels diminish the effectiveness of management measures. ICCAT may then request the revocation of their vessel registration or fishing licenses.

IOTC action in support of the IPOA-IUU fishing has included listings of vessels aimed at identifying IUU fishing vessels, port State control and trade documentation schemes. Establishment of a Compliance Committee is planned.

Regarding IUU fishing on the high seas, SPC is promoting responsible management of Pacific Islands open registries through the Divisional Maritime Programme Legal Section, and working towards instituting more formal mechanisms for provision of catch-effort information on high seas fisheries in the region through the Oceanic Fisheries Programme Statistics Section.

2.5.3 Addressing Specific Issues

The implementation of the precautionary approach is carried out by RFBs as follows:

- through the CCSBT's scientific processes and the setting of voluntary catch limits by members on the basis of that advice;
- the IATTC manages the fisheries utilizing precautionary principles and is in the process of incorporating a more formal procedure of scientific advice that utilizes the precautionary approach;
- ICCAT has established an *ad hoc* working group on the precautionary approach;
- IOTC reported that the implementation of a precautionary approach to fisheries management is reflected in the acceptance of the principle of incorporating uncertainty in stock assessments, but this has not been implemented to date. Operational models will be used to assess the consequences of management;
- implementation of the precautionary approach underlies all of SPC's activities, advice to its members and relations with other regional organizations; SPC advocates a precautionary approach in relation to both resource exploitation and social aspects of fisheries. This means that a reasonable doubt about the sustainability of the fishery must exist before the precautionary approach can be invoked. If this reasonable doubt cannot be established, and if there is reasonable doubt that peoples' basic livelihoods will be affected by a closure, then the criteria for invoking the precautionary approach would not be met.[79]

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[79] Where SPC assists in the development of inshore fisheries management policies, it builds in the precautionary approach into these policies. The precautionary approach has been clearly identified in the Pacific Islands Regional Ocean Policy (PIROP) under one of the guiding principles. The PIROP Vision Statement has been formally adopted as the vision statement of the SPC Marine Resources Division (this vision includes the scope of all Pacific Islands regional intergovernmental agencies).

Ecosystem management is included in the work of RFBs as follows:

- ICCAT's Standing Committee on Research and Statistics has a subcommittee on the Environment, which studies the effects of fisheries on the environment;
- for IOTC, ecosystem-based fisheries management is pursued through requesting data on NTADs (however, it is rarely available), observer coverage of about ten percent of vessels, and assessment of FAD deployment through tagging;

Approaches to address the concerns surrounding IUU fishing include the following:

- the extent, impact and effects of IUU fishing has been quantified by the members of CCSBT from domestic data and the Commission's trade information scheme;
- FFA provides some services to its members allowing them to assess the extent, impact and effects of IUU fishing, such as operation of a regional Vessel Monitoring System;[80]
- one of the main responsibilities of the IATTC Working Group on Fishing by non-parties is to assess the extent and impact of IUU fishing in the area of the Agreement;
- ICCAT has a scheme for port inspection as well as a Compliance Committee. ICCAT also has a Permanent Working Group on ICCAT Statistics and Conservation Measures, and the Standing Committee on Research and Statistics (SCRS);
- IUU catches are routinely estimated by IOTC from vessel listings, activity reports (port visits) and trade documents.

To strengthen the RFB's capacity to deal more effectively with conservation and management issues, the following steps have been taken:

- the CCSBT has developed a scientific research program to support stock assessment and management decisions;
- in ICCAT, two special Working Groups have been established: Working Group on Allocation Criteria and Working Group to Develop Integrated Monitoring Measures;
- in IOTC, funds have been secured from extra-budgetary sources for improvement of coastal State statistical systems and for tagging;
- SPC is continually expanding in size, and undertakes strategic planning to develop strengthened organizational capacity.

In accommodating new entrants into the fishery:

- the CCSBT has actively encouraged membership to accommodate new entrants. The Fishing Entity of Taiwan was admitted to the Extended Commission in August 2002. Encouragement is currently being given to South Africa and Indonesia to take up membership;
- in IATTC, new entrants have been accommodated, with several new members joining the Commission in the recent past;
- IOTC encourages participation of States with financial constraints under the status of Cooperating Non-Contracting Party.

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[80] However, because FFA does not have a management mandate, as noted above, it is not in a position to indicate activities, priorities or plans in relation to specific issues. It does, however, have important roles such as: the provision of information among FFA member countries and between the countries and the Agency; and assisting members in improving their capacity to manage and develop the tuna resources for their benefits. It these roles, FFA indirectly addresses the specific issues.

3. WHY IS FISHERY MANAGEMENT SUCCESSFUL (OR NOT)?

3.1 Successful Management?

The factors of unsustainability do not generally apply to tuna fisheries, because current information indicates that tuna stocks appear to be relatively healthy on a global basis, except for bluefin and bigeye, high value stocks which are under some stress. But it would not be wise to conclude that this is due to good fishery management. At national coastal State level, there has been scarce evidence of long-term tuna management: first there was industry-motivated non-recognition of coastal States' rights (and therefore management responsibilities) over tuna for many years after the adoption of the 1982 Convention. There is also the fact that national tuna management plans have proliferated only in the past few years, and in respect of the western central Pacific region this was in response to the development of the WCPT Convention.

At national level for some of the major tuna-fishing DWFNs, there is widespread concern about the absence of control over their tuna fleets, resulting in IUU fishing, non-cooperation with management measures set by RFBs and failure to join or observe at relevant RFBs. These are some of the key reasons that bluefin and bigeye stocks are declining.

At regional level, the mandates of most tuna RFBs were developed prior to the implementation of the 1995 UN Fish Stocks Agreement, and other post-UNCED international fishery instruments. However, they all appear to be involved in implementing as much of each instrument as their capacity, members and mandates permit. This has led to some success, especially in the western central Pacific which produces most of the world's tuna catch. Regional solidarity has been fostered by the FFA, even though it is not a "fisheries management organization" with a mandate for management measures. Some of its exemplary achievements have included the well-known Regional Register of Foreign Fishing Vessels, regional Treaty on Fisheries with the United States, minimum terms and conditions of fisheries access, cooperation in VMS and MCS, implementation of international instruments in national laws, active advice and analysis of markets and economics, providing advice in the development of domestic fishing industries, and serving as the region's Secretariat during the development of the WCPT Convention.

More generally, there have been successes in curbing IUU fishing (including "flag of convenience" fishing) through trade schemes, an increasing trend to set up registers and develop relevant information bases on vessels authorized to fish, and to share information as appropriate.

RFBs generally noted progress in identifying their priorities in implementing responsible fisheries management, using precautionary and ecosystem approaches to management, addressing by-catch issues, negotiating a new instrument to improve conservation and management; assisting in the implementation of robust laws, increasing membership and relations with other bodies and non-contracting parties; establishing scientific and research programmes, promoting aquaculture and industry development, assessing the extent, impact and effects of IUU fishing, addressing issues relating to capacity, accommodating new entrants, taking trade-related measures including catch certification and documentation.

So the question might be changed from "why is fisheries management successful (or not)", since tuna management has not yet appeared to result in unsustainable or overexploited fisheries. Instead, the question might be "how can management be improved or further developed to ensure continued sustainability of tuna?"

3.2 Factors impeding optimum tuna management by RFBs

Some factors impeding the achievement of optimum tuna management have been identified by RFBs, and discussed above. These include:

Internal/Institutional

- lack of mandate under establishing instrument;
- lack of support, political will by some members with a conflict of interest;
- need for strengthened and continuing programmes for scientific advice, research, stock assessments;
- need for timely statistics, information collection/distribution;
- need for financial resources to execute mandate;
- need for capacity building/financial support for administrations in member States;
- membership or cooperation by all fishing and coastal States.

External

- IUU fishing, including failure to report by members and non-members;
- increasing capacity of the fishing fleets.

3.3 Lessons learned from implementation of fishery management

As noted above, the sustainability of the tuna fishery may be unrelated to management efforts in some areas. A key feature of successful management in the western central Pacific region has been the coordination of coastal States through the FFA Secretariat, resulting in the harmonization of management principles and measures, together with a regional MCS/VMS programme. The technical backup of the SPC and development of information bases have also contributed to positive results.

In other regions, efforts by RFBs to implement the post-UNCED fishery instruments has yielded positive results and provided a suite of common denominators (and not necessarily the lowest ones!) for tuna management. Although ecosystem and precautionary approaches are still in early stages of development, new registers and information bases are being set up and new working groups being established to deal with current issues, the steps being taken are reasonably strong in the face of the difficulties expressed in section 3.2 and elsewhere in this paper.

4. HOW CAN THE DIFFICULTIES AND OBSTACLES BE OVERCOME?

As noted above, tuna fisheries are largely sustainable only partly because of management. Difficulties and obstacles – or challenges - for tuna fisheries may be anticipated in future, however. These would build on the current challenges, but should not be considered without reference to projections for global markets, marketing and technological developments (both for fishers and fisheries managers/enforcement). Although the latter is beyond the scope of this paper, Workshop participants are invited to take into account any such factors in considering challenges and obstacles to be overcome.

A starting point is that existing instruments are adequate to manage tuna fisheries. RFBs and States are only in early stages of implementing many of the requirements and concepts, and would need several more years to develop them properly.

The next step is recognition of the fact that tuna are highly migratory, and cooperation is needed to manage them throughout their range. This should not compromise coastal State sovereign rights, but should promote healthy coordination and reasonably consistent management through regional fishery bodies to the extent possible. The way forward would be to work on national and regional levels. First to promote further development of tuna management plans and ensure appropriate legislative and administrative frameworks are in place at national level, and strengthen RFBs wherever possible to address the constraints identified above. FAO is promoting the latter through a range of projects, including coordinating the third meeting of regional fishery bodies in Rome, 3-4 March 2003.

The solutions identified in the Bangkok Workshop could be applicable to tuna fisheries managed by RFBs as well as to coastal or fishing States as follows.

- Development of allocation of rights will be an issue in future tuna management for some RFBs. Much attention has already been given to this issue (e.g. in the preparatory stages of establishing the WCPFC), especially in the context of rights-based fishing, “real interest”, past fishing patterns, contribution to research and other factors. This will be receiving further attention;
- many RFBs are striving for transparency to the extent possible. As noted above, many non-members are being invited to participate in the work of RFBs;
- participatory management may be more difficult to achieve in the context of RFBs, as fishers would be liaising with their national State;
- precautionary and ecosystem approaches have been adopted by some RFBs, and any successes could be exemplary for other RFBs or States;
- capacity building for RFBs and national administrations is important for successful management, and is acknowledged by tuna RFBs, noted above.
- public awareness building is undertaken by some RFBs, and could prove to be useful precedent for others;
- market incentives for tuna fisheries are less important than disincentives to market IUU caught fish. To this end, further development of trade, documentation and certification schemes could be useful.

Otherwise, factors impeding optimum tuna management noted in section 3.2 above should be considered with a view to overcoming the impediments described, mindful of ongoing activities of the RFB and FAO in that regard.

ANNEX 1

SUMMARY INFORMATION ON REGIONAL TUNA FISHERY BODIES

Body	Establishment	Headquarters	Membership	Area of Competence	Main Functions
IATTC Inter-American Tropical Tuna Commission	1949 International Convention	La Jolla, California, USA	Costa Rica, Ecuador, El Salvador France, Guatemala, Japan, Mexico, Nicaragua, Panama, Peru, USA, Vanuatu and Venezuela.	Eastern Pacific Ocean	To gather and interpret information on tuna; to conduct scientific investigation; to recommend proposals for joint action for conservation.
ICCAT International Commission for the Conservation of Atlantic Tunas	1966 International Convention	Madrid, Spain	Algeria, Angola, Barbados, Brazil, Canada, Cape Verde, China, Côte d'Ivoire, Croatia, Equatorial Guinea, European Community, France (St. Pierre and Miquelon), Gabon, Ghana, Guinea Conakry, Honduras, Japan, Korea (Rep. of), Libya, Mexico, Morocco, Namibia, Panama, Russia, Sao Tomé and Principe, South Africa, Trinidad and Tobago, Tunisia, United Kingdom (Overseas Territories), United States, Uruguay, and Venezuela.	Atlantic Ocean including the adjacent seas	To study the population of tuna and tuna-like fishes; to make recommendations designed to maintain these populations at levels permitting maximum sustainable catch.
FFA South Pacific Forum Fisheries Agency	1979 International Convention	Honiara, Solomon Islands	Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Western Samoa.	South Pacific (Central and West)	To harmonize fishery management policies; to facilitate cooperation in surveillance and enforcement, processing, marketing and relations with third countries; to arrange for reciprocal access by member countries to their respective 200-mile zones.
WIOTO	1991	Mahé, Seychelles	Seychelles, Mauritius, Comoros,	Western Indian	To harmonize policies with respect to fisheries;

Body	Establishment	Headquarters	Membership	Area of Competence	Main Functions
Western Indian Ocean Tuna Organization	International Convention		India	Ocean	to determine relations with distant water fishing nations; to establish mechanism for fisheries surveillance and enforcement; to cooperate for fisheries development; and to coordinate access to EEZs of the members.
IOTC Indian Ocean Tuna Commission	1993 International Agreement under aegis of FAO (Article XIV of FAO Constitution)	Victoria, Seychelles	Australia, People's Republic of China, Comoros, Eritrea, EC, France, India, Iran, Japan, Korea, Republic of, Madagascar, Malaysia, Mauritius, Oman, Pakistan, Seychelles, Sri Lanka, Sudan, Thailand, United Kingdom	Indian Ocean and adjacent seas north of the Antarctic Convergence	To promote cooperation in the conservation of tuna and tuna-like species and also promote their optimum utilization, and the sustainable development of the fisheries.
CCSBT Commission for the Conservation of Southern Bluefin Tuna	1994 International Convention	Canberra, Australia	Australia, Japan, New Zealand	Atlantic, Pacific and Indian Oceans where SBT are found	To collect, analyse, and interpret scientific and other relevant information on SBT, to adopt conservation and management measures including the total allowable catch and its allocation among the Members.
WCPFC Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean	2000 (signed, not yet in force at time of writing) International Convention	(not yet established at time of writing)	Signatories: Australia, Canada, China, Cook Islands, Federated States of Micronesia, France, Fiji Islands, Indonesia, Japan, Kiribati, Marshall Islands, New Caledonia, New Zealand, Nauru, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Tonga, Tuvalu, United Kingdom (Pitcairn Island), United States of America, Vanuatu and Wallis and Futuna	Boundaries south and east, area to cover range of tuna stocks	*inter alia:* determine the total allowable catch or total level of fishing effort within the Convention Area for such highly migratory fish stocks as the Commission may decide and adopt such other conservation and management measures and recommendations as may be necessary to ensure the long-term sustainability of such stocks; (b) promote cooperation and coordination between members of the Commission to ensure compatible conservation and management measures; (c) adopt, where necessary, conservation and management measures and recommendations for non-target species and species dependent on or associated with the

Body	Establishment	Headquarters	Membership	Area of Competence	Main Functions
					target stocks, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened.
TECHNICAL BODY					
SPC Secretariat of the Pacific Community	1948 International Agreement	Noumea, New Caledonia	American Samoa, Australia, Cook Islands, Federated States of Micronesia, Fiji, France, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Palau, Papua New Guinca, Pitcarin Islands, Samoa, Solomon Islands, Tokclau, Tonga, Tuvalu, United Kindgom, United States, Vanuatu, Wallis and Futuna	South Pacific South of the Equator	To provide a regional service which provides information, advice and direct assistance to the Pacific Community through SPC member governments, either individually or collectively, in using living marine resources in the most productive and responsible manner possible, in particular through fisheries stock assessment, marine ecosystem research, small-scale tuna fisheries development support, coastal fisheries management support and fisheries information and databases throughout the area of competence.

ANNEX 2

REGIONAL TUNA BODIES RESPONSES

INDICATIVE ISSUES IMPORTANT TO REGIONAL FISHERY BODIES

A range of issues and challenges have faced RFBs in recent years, including those relating to effective governance by the RFB and to the conservation and management of the resource. The Secretariats of the RFBs were requested to indicate the five most important issues for them, and the reasons why they are important. Some RFBs indicated more than five issues, and some indicated less. If an RFB did not indicate an issue as a priority, this does not necessarily mean the issue is unimportant for the RFB. A summary of the priority issues and reasons identified by the Secretariats is in Part I.

The identification of priority issues is indicative only, since member countries have not formally reviewed the information, and mandates of RFBs are diverse. Many of the areas identified are overlapping, and for this reason issues important to some RFBs were not designated. This may not be clear from the categories identified by RFBs. However, taken together they show the general trends at the time of writing and may assist in reaching a clearer understanding of the challenges facing RFBs.

ISSUES	IOTC	FFA	IATTC	SPC	CCSBT
1. Implementing responsible fisheries management	▨		▨		▨
2. Ecosystem approach to fisheries management			▨	▨	
3. By-catch			▨	▨	
4. IUU Fishing	▨				▨
5. Application of the precautionary approach				▨	
6. Conflicts of interest at national level	▨				
7. Increasing fishing capacity of the fleets			▨		
8. Managing conflicts between artisanal and industrial fisheries		▨			
9. Sound scientific advice, research, stock assessments, ecosystems,[81] etc.				▨	▨
10. Statistical database; need for timely statistics, information collection/distribution	▨			▨	
11. Decline, restoration, recovery and conservation of certain fish stocks					▨
12. Need for a Scientific Research Programme					▨
13. Strengthening cooperation/coordination internally, with other RFBs and bodies		▨			
14. Need for financial resources to execute mandate			▨		

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[81] This includes producing scientific advice decision-makers need, need for continuing, accurate, comprehensive stock assessments, assessments of associated species and ecosystems at national, regional levels.

ISSUES	IOTC	FFA	IATTC	SPC	CCSBT
15. Method of determining financial contributions					
16. Need for capacity building/financial support for administrations in member States	▨	▨			
17. Human resource development				▨	
18. Information exchange among member States, to decisionmakers and the public		▨		▨	
19. Membership	▨				▨
20. Negotiation of a new Convention			▨		
21. Establishment of the Western and Central Pacific Tuna Commission		▨			
22. Aquaculture development				▨	
23. Tuna industry development		▨			
24. Change in balance between subsistence/ commercial fisheries				▨	

ANNEX 3

REGIONAL TUNA BODIES RESPONSES

IMPLEMENTATION OF POST-UNCED INTERNATIONAL FISHERIES INSTRUMENTS

Respondents were requested to provide information regarding recent activities, priorities or plans to implement the post-UNCED fishery instruments. Shaded cells indicate where a response was received and further details, as available, are in the text relating to each RFB.

Where RFBs indicated that the instruments in general are not relevant to their work this is indicated in a footnote. Where they have indicated specific instruments are not relevant, this is included in the text relating to each RFB. In some cases, where RFBs do not have a mandate to implement the instruments, reported action taken consistent with the instruments is indicated by shaded cells.

RFBs that did not respond are not included in the Table.

	1993 FAO Compliance Agreement	**1995 UN Fish Stocks Agreement**	**1995 FAO Code of Conduct for Responsible Fishing**	**IPOA on Reducing the Incidental Catch of Seabirds in Longline Fisheries**	**IPOA on the Conservation and Management of Sharks**	**IPOA on the Management of Fishing Capacity**	**IPOA on the Prevention, Deterrence and Elimination of IUU Fishing**
ATLANTIC OCEAN AND ADJACENT SEAS							
ICCAT[82]	▨	▨	▨			▨	▨
INDIAN OCEAN AND INDO-PACIFIC AREA							
IOTC	▨				▨	▨	▨
PACIFIC OCEAN							
FFA[83]							
IATTC	▨	▨	▨		▨	▨	▨
SPC	▨	▨	▨	▨	▨		▨
TRANS-OCEAN							
CCSBT	▨	▨	▨	▨	▨	▨	▨

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[82] No specific information received, shaded areas were taken from information on website.

[83] Not directly relevant, as FFA is not strictly a fisheries management agency.

REGIONAL TUNA BODIES RESPONSES

ADDRESSING SPECIFIC ISSUES

Respondents were requested to indicate if their RFB has recently undertaken any activity, priorities or plans in relation to the following issues. Shaded areas indicate an affirmative response, and further details, as available, are in the text relating to each RFB.

Where RFBs indicated that the issues are not generally relevant to their work this is indicated in a footnote. Some RFBs indicated that some issues are not relevant, and this is included in the text relating to each RFB.

RFBs that did not respond are not included in the Table.

	Implementation of precautionary approach	**Addressing ecosystem based fisheries management**	**Assessment of extent, impact, effects of IUU fishing in area of competence**	**Strengthening RFB's capacity to deal more effectively with conservation, management issues**	**Addressing issues relating to capacity**	**Accommodating new entrants**	**Catch certification and documentation**
ATLANTIC OCEAN AND ADJACENT SEAS							
ICCAT[84]			▨	▨			
INDIAN OCEAN AND INDO-PACIFIC AREA							
IOTC	▨	▨	▨	▨	▨	▨	▨
PACIFIC OCEAN							
FFA[85]							
IATTC	▨	▨	▨	▨	▨	▨	▨
SPC	▨	▨	▨	▨	▨	▨	▨
TRANS-OCEAN							
CCSBT	▨		▨				

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[84] No specific information received, shaded areas relate to various committees established to address activities, noted in text.
[85] Not directly relevant, as FFA is not strictly a fisheries management agency.

DISCUSSION PAPER 5

THE BRITISH COLUMBIA ROCKFISH TRAWL FISHERY

by

Jake Rice[86]

Summary

Throughout this report, reference is sometimes made to the BC groundfish fishery and sometimes to the BC rockfish fishery. The analysis is specifically of the multi-species rockfish fishery. However, many of the management innovations were directed at the entire trawl sector and not just the portion of the trawl fleet specialising on rockfish. It is hoped that usage is clear on a case by case basis.

This fishery was selected because it combines many of the greatest challenges of multi-species tropical fisheries with the technology and institutions of developed-world Northern Temperate fisheries and management. It has many interesting stories to tell, and lessons to illustrate. This meant that the report is somewhat long; a shorter contribution would require greater preparation time. An evaluation within the framework set by the International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries held in Bangkok, Thailand 4-8 February 2002 ("the Bangkok Workshop")[87] appears in section 3: Why is Fisheries Management Successful (or Not). The rationale for the conclusions, together with the history, appears in the preceding sections.

1 THE WEST COAST OF CANADA ROCKFISH FISHERY

1.1 Description of the resource

At least 36 species of rockfish (*Genera Sebastes* and *Sebastolobus*; Family *Scorpaenidae*) occur regularly along the coastal regions, continental shelf, and slope of the Canadian Pacific coast. There are probably fine-scale differences in habitat preferences among the rockfish species, but these are poorly known. Generally subgroups of species are recognised, and commonly referred to as "inshore rockfish"88, "shelf rockfish"89 and "slope rockfish"90. Even these categorisations are rough, with many species being present in more than one habitat type and simply more common in one of the three (Love et. al. 2002).

Some species are considered closely tied to the seafloor, particularly many of the inshore rockfish (reported for copper rockfish, quillback, tiger rockfish). Others may be diurnally migratory, spending the night foraging up in the water column and days densely schooled near the sea floor (reported for widows, Pacific Ocean perch, yellowtail rockfish; ex Stanley et. al 1999). The juveniles of many slope and shelf species are largely pelagic, and some, such as yellowtail rockfish and black rockfish remain largely pelagic as adults. As expected from the name "rockfish" the species generally occur over hard, structurally complex substrates, but this tendency is also relative, not absolute. Adults are generally considered to be fairly sedentary, particularly in the inshore group, but extensive movements by tagged individuals have been recorded in many species. This sedentary tendency, combined with a preference for structurally complex habitats, means that there is almost certainly meta-population structure in many of the species. Some biochemical genetic work has been conducted on rockfish is recent years, and not surprisingly, shows complex population structure is common in the species that have been studied. However, knowledge of population structure is still in its infancy, and management are quite large, generally reflecting only major depth or substrate discontinuities.

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[86] The views expressed in this paper are solely those of the author, Jake Rice, Director, Science Advisory Secretariat, Department of Fisheries and Oceans, Government of Canada, Ottawa, Canada RICEj@DFO-MPO.GC.CA.

[87] FAO Fisheries Report No. 672, FIPP/R672, held under the FAO/Japan Government Cooperative Programme.

[88] Typical "inshore rockfish" include China rockfish (*Sebastes. nebulosus*), copper rockfish (*S. caurinus*), quillback (*S. maliger*), tiger rockfish (*S. nigrocinctus*), and yelloweye rockfish (*S. ruberrimus*).

[89] Typical "shelf rockfish" include Boccacio (*S. paucispinis*), Canary rockfish (*S. pinniger*), silvergray rockfish (*S. brevispinis*), widow rockfish (*S. entomelas*) and yellowtail rockfish (*S. flavidus*).

[90] Typical "slope rockfish" include Pacific Ocean Perch (*S. alutus*), redstripe rockfish (*S. proriger*), rough-eye rockfish (*S. aleutianus*), shortspine and longspine thornyheads (*Sebastolobus alascanus & altivelis*, shortraker rockfish (*Sebastes. borealis*) and yellowmouth rockfish (*S. reedi*)

Rockfish are long-lived, with fish aged up to 100 years or more commonly encountered in lightly exploited populations (a rougheye rockfish was aged at 205 years). They also mature relatively late; from the early teens to 30 years or more. Rockfish have internal fertilisation and are live-bearers, although reproductive traits vary among species and have been studied thoroughly in very few. It is widely believed that stocks depend on the highly sporadic production of strong year-classes to replenish biomass, and in a typical year production of recruits is very low. However although rockfish have clearly marked otoliths, the slow growth and long life spans mean that accurate aging of adult rockfish is difficult, and year-classes cannot be resolved with precision.

Taken together, these life history traits mean that adult populations of rockfish can sustain only very low exploitation rates. Because many slope and shelf species commonly school densely and come off the sea floor, and present strong hydroacoustic signals, the species are highly vulnerable to fishing. Little is known of the dispersal of young with or without density dependence in habitat quality and population density. However, because rockfish are generally live-bearing, the potential for dispersal of progeny is thought to be lower than for many other species supporting directed commercial fisheries.

1.2 Description of the fishery

Of the 36 species of rockfish along the BC coast, at least 14 are harvested commercially. Moreover, mixed catches are the rule, with four being the modal number of species per tow in the shelf trawl fishery during the mid 1990s. Long-standing prohibitions on trawling in near-shore areas, to avoid conflicts with sport salmon fisheries, means that exploitation of inshore rockfish has been almost exclusively by hook-and-line gears. This became a limited-entry fishery in 1992. It is prosecuted primarily by vessels under seven metres and serves a speciality high-value restaurant market for live rockfish. With the decline in salmon stocks, the sport fishing sector turned attention to inshore rockfish. Inter-sectoral conflicts have led to major changes and many area closures in the hook-and-line rockfish fishery.

This inshore hook-and-line fishery has some interesting features, but will not be the focus of this report. Reference will be made to it in a couple of places where the developments are particularly relevant to building an understanding of the evaluation framework with which we are working. However, the fishery developed completely independently of the trawl fishery that is the focus of this evaluation.

The first commercial harvest of the shelf and slope rockfish stocks preceded extension of jurisdiction, when distant-water fleets from several countries “discovered” and first fished many of the rockfish stocks and species along the coast. Catch records and biological samples from that period from the late 1940s to the early 1960s or even later are poor and known to be incomplete. However, all indications are that at least major stocks of the more attractive species such as Pacific Ocean Perch were overfished during this period, and have never fully recovered.

When the 200-mile limit was implemented, the Canadian trawl fleet was put under limited entry. Total licenses never exceeded 142 for all groundfish, and more than 25 of those were inactive for most of the 1980s onward. Of the active groundfish trawl licenses, some license holders primarily took rockfish incidentally while pursuing other species, whereas some others specialised heavily in them. The analysis that follows is for the trawl fishery component of the rockfish fishery, covering almost the entire harvesting of shelf and slope species.

In British Columbia, fisheries have always been a secondary component of the provincial economy. Industry, trade and tourism all are strong, and of resource-based industries, forestry dominates over fishing and mining is also significant. Moreover, within the fishing sector, salmon has always dominated the public opinion and government policy environments. Until the 1990s the commercial salmon fishery also dominated economically. Beginning in the 1980s rapid development of the sport fishing sector, especially the commercial-recreational (tour outfitters) created major management and policy challenges for the salmon fishery. During the 1990s major declines in the status of many salmon stocks, as a consequence of numerous factors but particularly an unfavourable ocean environmental regime for salmonid productivity, exacerbated the difficulties in salmon fisheries, management and policy setting. This is germane to the rockfish trawl fisheries, and other fisheries particularly developing fisheries for invertebrates, because it focused both public and political attention on the salmon fisheries. This focus (obsession?) on salmon allowed developments in the other fisheries to take place away from intense external scrutiny.

Innovative development was aided by groundfish processing (other than the high-volume conversion of Pacific hake [*Merluccius productus*] into surimi) being centred in just two ports. The Co-op plant in Prince Rupert in the North Coast of BC was a major local employer. On the other hand, Steveston, a suburb of Vancouver, received the majority of rockfish landings, but the employment created in fish processing was economically a minor factor regionally. Over most of this period only three companies processed rockfish for export, which also facilitated innovation and experimentation in management activities. The processors were strongly committed to long-term stability of supply of product to markets, which made them allies of the managers in achieving sustainable harvesting. Moreover, in the mid 1990s one of the companies based in Steveston purchased the Prince Rupert Co-op, further consolidated the processing sector.

By the end of the 1990s the value of the groundfish trawl fishery exceeded the value of the commercial salmon fishery substantially, as did the combined value of invertebrate fisheries. The creative bookkeeping in the recreational and commercial-recreational fisheries for salmon makes it difficult to compare value with those fisheries. However salmon still dominate the policy and public opinion climates in BC.

Through the 1990s there were major changes in management approach to the BC trawl fisheries, as industry and government both sought sustainability in harvesting and responded to changing markets and policy frameworks. These changes comprise the core of the assessment below.

2. IS FISHERY MANAGEMENT SUCCESSFULLY ACHIEVING THE FOUR COMPONENTS OF SUSTAINABILITY?

2.1 Bio-ecological component of sustainability

Does the organization (national/regional/provincial government and or regional fishery management organization) responsible for fishery management understand that its main bio-ecological aim is to protect, conserve, and restore fishery resources, the environment, the habitat, the ecosystem and bio-diversity; that overfishing should be prevented, and that the resources, the habitat and the ecosystems should be restored to conditions capable of producing the Maximum Sustainable Yield (MSY), taking into account multispecies and ecosystem considerations?

What concrete actions substantiate that the organization does / does not understand its main bio-ecological aim?

From the mid 1980s onward, the rockfish trawl fisheries were managed with an objective of keeping fishing mortality ~ natural mortality (PSARC 1985). This F = m strategy had been proposed as a generally robust management strategy for long-lived species. This harvesting strategy meant that the target exploitation rate was at or less that 5 percent of standing biomass annually. Notwithstanding a substantial increase in knowledge about rockfish biology, a 2-5 percent exploitation rate is still considered a reasonable target for these fisheries (Clark 1991, Restrepo *et al* 1998).

Not surprisingly, industry perceived a five percent exploitation rate as highly conservative, and the Science community invested substantial time in informing industry of the biological imperative of leaving the very large majority of the fish they detected on their sounders in the water. Special meetings were held between biologists and harvesters in the late 1980s and early 1990s, to discuss the rationale for the target exploitation rate, leading to a planned experiment with industry to demonstrate the impact of higher exploitation rates on stock status (Leaman and Stanley 1990).

This experiment had both desired and undesired consequences. In the first phase of the experiment, which involved a pulse of five years of intentional overfishing of one discrete area, working relationships with industry improved greatly, and industry gained experience in accurate catch monitoring. A marked signal was inflicted on the age composition of the targeted Pacific Ocean Perch stock. The second phase of the experiment, consisting of a five-year total closure, proved difficult to implement. One plant had become dependent on landings from the overfishing phase of the experiment, and new staff in fisheries management and a new party in power in the federal government were sympathetic to continuing the local employment that had been provided. The second treatment was implemented after two years of postponement (and continued overfishing) and the results, from monitoring in the last 1990s, provided Science, Fisheries Management, and industry much improved estimates of stock productivity, aging accuracy, and levels of sustainable exploitation. Many of the results are available in the primary and fisheries literature (Leaman and Stanley 1993).

Throughout the 1990s, annual briefings of the trawl industry on results of stock assessments included review of the rationale for the target exploitation rate. These efforts were widely, but not universally, successful in building industry support for the target exploitation rate. By the end of the 1990s, disagreements between industry and Science were primarily centred on the accuracy of estimates of stock size, and not the exploitation rate to be applied to the stock. When the periodic assessments failed to show evidence that stocks were continuing to increase, industry, as well as the Department, took these signals seriously (Minutes of Groundfish Trawl Advisory Committee)

The TAC-based management applied to only a few core species in each of the shelf and slope complexes. The information and resources needed by Science[91] and Fisheries Management to support TACs for even for these few species proved hard to meet. Assessments of stocks with such low exploitation rates converge very slowly, the stocks are hard to survey, and there are more than a score of cohorts in the annual catch at age matrix, yet ageing has non-negligible errors. It was recognised by both Science and Fisheries Management that the many other species not being managed to individual TACs were vulnerable to overharvesting, and a variety of much more *ad hoc* measures were added to management plans to address these concerns. In the early 1990s management of the quota rockfish included trip limits for each trip, as well as the TAC, divided into quarters. The Department also implemented trip limits for catches of many "minor" rockfish species (Table 1), which were combined with limits on the number of trips per month to restrict catches of the minor stocks, even though an overall biologically-based annual ceiling on catches was not set for these species.

Industry found it impossible or inefficient to fish for a large number different trip limits. Because completely "clean" targeting by species was impossible within the complexes, either trips had to be terminated with the first limit was reached, or crews discarded species whose limits were being approached (Richards 1994). Therefore, in the mid 1990's industry and Science developed a system of aggregate management (Rice and Richards 1995), which fisheries management accepted. This system allowed some overages of trip limits on single trips, with the species-specific trip limit of the next trip reduced correspondingly. The intent was to keep in place incentives to industry to harvest selectively among species within the shelf and slope complexes according to whatever was known of their relative sizes and productivities, but not require perfect accuracy on a trip by trip basis. Two other checks were put in place as well, to keep exploitation from becoming excessive. One was an aggregate limit for each trip across co-occurring species within each complex, to prevent the overage allowance from being used as an opportunity to go over many individual limits on the same trip. The second was a rule that if specific limits were exceeded in two consecutive trips, an observer was obligatory on the next trip, and if an overage on the same limit occurred on that trip, the vessel lost an allowed trip in the next quarter, when all stocks had new quarterly TACs to harvest.

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[91] The Canadian Department of Fisheries and Ocean contains a sector entitled Science Branch and a sector called Fisheries Management Branch. The separation of duties between the Branches follows very much what would be expected given their names. Throughout this Report, when reference is made to the DFO sectoral entity, "Science" and "Fisheries Management" will be capitalized. When the words occur without capital letters the reference is to the activities of doing research or managing fisheries in a more generic sense.

The system of many-species trip limits and multi-species trip limits with the aggregate & overage system both were complex to develop and challenging for both industry and government to implement and maintain. They gave way in the late 1990s to an IVQ system described under the institutional sustainability section. However, their very existence, and the desire of both government and industry to go to such lengths to conserve a large number of species being harvested together, clearly documents an understanding of the need for conservation of the resource base on which the fishery depends.

Fisheries, of course, affect more than the species on which they target. Both by-catch and effects of the fishing gear on habitats are issues for mobile trawl gears. For rockfish, the major by-catch issues were within the fishery; it was the mixed species rockfish catches which presented the major challenges. Non-rockfish by-catch was low to begin with, and with the low sustainable exploitation rate of rockfish, other species taken incidentally could almost always sustain the by-catch mortality suffered in these fisheries.

Impacts of trawls on the seafloor were another story. Although some species could be harvested effectively with pelagic trawl gears, many could not be. Moreover, with a general preference of rockfish for hard bottom and complex substrates, trawling was focused on substrate types vulnerable to damage. Through the 1980s and early 1990s this ecosystem aspect of sustainability was largely ignored (or brought out to threaten industry when other discussions were going poorly). As the profile of this issue grew, discussions were held with industry to gain agreement to restrict fishing to areas traditionally trawled, with the objective of at least containing impacts to areas already affected the most by trawling. Industry was sympathetic to these discussions, in that substantial costly gear damage was common when unfamiliar grounds were fished. These efforts were aided by reductions in annual effort levels, as TACs were reduced to bring exploitation rate down to the goal of <5 percent. Reduced TACs combined with trip limits necessarily resulted in fewer trips, and hence fewer opportunities to impact habitat.

On the other hand, as trip limits became more restrictive on fishing choices, and better enforced, industry was continually seeking locations where the catches were novel mixes of species – lots of the species for which there was room in the trip limit, and little of the species whose limits were being approached. This created a positive incentive to continually be exploring new fishing sites. In response to these conflicting pressures, more and more areas were designated as closed to trawling. Originally closed areas were selected largely to avoid known concentrating areas for juveniles or parturating females (Live-bearers don't spawn), or conflicts with other fisheries. However, by the end of the 1990s, the roster of closed areas had risen from seven (1992) to nearly 30 areas outside the Strait of Georgia and Johnstone Strait area, and nearly a third of the entries were based at least in part on protection of vulnerable habitat substrates. Some others were intended for conservation of rockfish itself, such as the seasonal closure of the mouth of Goose Island Gully. Mature female Pacific Ocean perch congregate there to release their larvae, and during the parturating season catches are more than 85 percent females. Industry has supported the prohibition on fishing there during the spawning season for more than a decade, despite exceptionally high catch rates of large fish during that period. Moreover industry itself has proposed some areas to the department that it argued needed protection, most notably a large area of deep-water sponges.

Taken together the developments in management of this fishery since the 1980s clearly documents that the Department does understand the complex bio-ecological aim of conservation of the resource base, and the ecosystem in which the resource occurs. Not all the complexities were grasped initially – nor even now and the attempts to accommodate the complexities in management were at best incomplete successes. Nonetheless the efforts attest fully to the knowledge that these things do matter, and must be priorities.

2.2 Social component of sustainability

Does the organization (national/regional/provincial government and or regional fishery management organization) responsible for fishery management understand that its main social aims are to achieve optimum utilisation of the resource, ensure safe, healthy and fair working environments and conditions, that they should be considered a means to promote diversification of income and diet, and that they should assist developing countries.

What concrete actions substantiate that the organization does / does not understand its main social aim?

The role of the rockfish resource and fishery in supporting social well-being, equity, and stability has rarely been articulated clearly, and has not often even been a topic of discussion outside those directly associated with the fishery and processing sectors. As noted in the description of the fishery, the spotlights of public opinion and government policy focused much more on salmon fisheries, and economic concerns extended beyond salmon to herring, but not much further.

In the context of a safe, healthy and fair working environment the processing sector of this fishery stands up well. The workforce in the processing sector has been unionised for decades, and the union had a strong track record of addressing issues of workplace safety and employment in the processing plants. Plant owners commonly complained that the cost of worker benefit packages made their products un-competitive on international markets. However, their primary action to address that problem was to seek ways to increase product value, and not withdraw benefit packages.

On the vessels few crew were unionized. Rather, the large majority of vessels were owner-operated, and employed quite small crews (rarely more than four-five individuals. Rockfish trawl fishing was always considered a high-skill occupation, because of the skills required to fish effectively on hard-substrate bottom and to match species composition of catches to the complex suites of trip limits that applied at any particular time. There was strong competition for experienced crew, and crew shares - the basis of payment - were considered generous in comparison to working in the salmon fleet. Vessel conditions were not always comfortable, but trips were generally short, pay was good, and to my knowledge workplace safety on vessels was reasonable for a fishery. Certainly in eight years of attending meetings with industry it was never raised as an issue.

In terms of economic diversification, there were never any efforts to put more licensing capacity into the fishery – rather the pressure was to reduce fleet size to address issues of biological sustainability. Within the licensed trawl fleet, the move from Pacific cod and flatfish to rockfish was itself an attempt to diversify the trawl fleet. Prior to the late 1970s almost all the rockfish were harvested by distant water fleets with non-Canadian crews landing in foreign ports. New skippers found it more challenging to fish rockfish than other trawl species, and only built up the proportion of rockfish in their catches slowly. However with sufficient skill vessels could earn higher returns by specialising on rockfish than cod and sole, so the rockfish fishery became the “endpoint” of fleet diversification.

Only the largest trawl vessels could harvest volumes of Pacific hake large enough to participate in the summer hake fishery, and few of those vessels could cover expenses fishing to the comparatively small rockfish trip limits. At the other end, many of the smaller vessels in the trawl fleet also fished herring with gill nets during the brief herring roe fishery. However, regulations intended to minimise competition among different fleets forbid trawls from retaining salmon or Pacific halibut. These regulations impeded diversification in favour of protecting historic *status quo* situations among fleets. This could be viewed as protecting the stability of social structures, but was perceived by the trawl fleet as protecting established interests from competition from more a innovative and adaptable fleet.

In terms of optimal use of the resource, three points are relevant. With regard to merely optimising catch, many management measures were explored in attempts to spread the fishery through the year, rather than have the large harvesting capacity of the fleet take the full TAC in the first few weeks of the fishing year. These measures included dividing the TAC into four quarterly portions (not necessarily equal), and further implementing trip limits for every species within the quarterly quota. These measures were all justified on grounds of optimising economic value of the resource than in terms of maximising value to society, however, and will be picked up in the next section.

Socially optimally use was a primary consideration in government initiatives to direct where catches would be landed. Originally the Prince Rupert Co-op branched into processing rockfish to fill slow periods in the salmon fishery. Their distance from markets made it difficult to compete with the Steveston plants. However, the Langara Spit experiment referred to earlier produced a regular supply of rockfish to the Co-op, and over just a few years a local dependency on processing jobs developed. The desire by the community to keep the jobs, supported by the local Minister of Parliament, in fact because a pressure to continue unsustainable fishing in the northern waters of BC. This was only resolved when one of the Steveston-based companies bought the Prince Rupert plant and agreed to direct some portion of landings to it throughout the year. The company was held to this commitment, despite strictly economic reasons to consolidate landings close to the markets, until IVQs were introduced and the entire nature of the fishery changed.

In the early 1990s, processing plants in Washington State began to make offers to rockfish skippers to buy their catches taken in BC. These plants were located in Puget Sound, and just as easy and cost-effective to reach as Steveston. To the vessel skippers, these offers were attractive, as the US plants offered several cents a kg more than offered for the same fish by BC-based plants. Fuel in the US was also cheaper. The BC processors appealed to the federal and provincial governments to prevent non-Canadian landings, arguing that the price differential was caused by the higher wages and greater benefits paid to the processing workforce in Canada. These differential costs were in Canada's interests, and in part to comply with Canadian social legislation.

The Canadian government did invoke a land-in-Canada requirement for all fish harvested in Canada. However, rather than tie the regulation specifically to supporting Canadian plants, the announced basis for the regulation was protection of the resource. Under the management plan of the day, subscription of quotas was being monitored for eight-ten rockfish species and compliance with trip limits for nearly 20 species. Because the US plants did not report rockfish landings by species, it was argued that the entire approach to management to achieve conservation would be jeopardised by US landings (memo 28 September 1992, Director Fisheries Management to Regional Director General). The US plants offered to discuss implementing administrative measures to ensure effective monitoring and reporting of catches by Canadian vessels, to ensure compliance with the Canadian management plan. Nonetheless, through most of the 1990s agreement could not be reached on what administrative measures were adequate to satisfy Canadian management, and a de facto land-in-Canada policy was kept in force. In this case optimal use for on sector of society (plant workers – and owners) was perceived as achieved at the expense of sub-optimal use for another segment of society (license holders and crew). Again, the complete overhaul of this fishery with implementation of IVQs affected the land-in-Canada requirements.

2.3 Economic component of sustainability

Does the organization (national/regional/provincial government and or regional fishery management organization) responsible for fishery management understand that its main economic aims are to match fishing capacity to the productive capacity of the resources, the environment and the ecosystem;

to conduct trade according to the World Trade Organization (WTO) rules, including the elimination of subsidies and to prevent illegally caught fish from reaching their markets.

What concrete actions substantiate that the organization does / does not understand its main economic aim?

Early in development of the Canadian West Coast trawl fishery, limited entry was implemented (1976). This capped the fleet at about 140 vessels which, given the size and technology of the day, was considered reasonable matched to the resource productivity. Moreover, all but about 20 of these vessels had licenses in other fisheries, such that in any given year nearly a third of the fleet might not pursue groundfish. Those vessels that were active fished many species besides rockfish, which comprised less that 15percent of the groundfish catch by volume but nearly 30 percent by value (1991 statistics). Not only was the fleet relative modest in numbers, more than two thirds of the vessels were less than 30 meters in length. By the mid 1980s there was also a vessel replacement regulation that although licenses could be transferred among vessels, replacement vessels could not be larger than the vessel being replaced.

Notwithstanding these measures to regulate capacity, the low productivity of rockfish and the diversity of species mean than TACs could be fully taken within just a few weeks of openings. This would produce the typical economic inefficiencies of market glut with poor prices, followed by long periods of lay-ups. The negative economic consequences of such a strategy would be amplified by the much larger quotas of flatfish and Pacific cod, which would have gone largely unharvested. Hence by the early 1990s, the management plan had a variety of provisions whose sole purpose was to allow a 12-month fishery. These measures included species-specific trip limits for each “rockfish trip”, and a limit of either two or three trips per month per vessel. (The two-trip or three-trip options were associated with different trip limits, to accommodate the different economies of the larger and smaller vessels in the trawl fleet, but keep the playing field level.). The measures also included an unlimited number of “incidental” rockfish trips, where the rockfish catch was below a specified tonnage, so fishing for other species could continue without requiring the discarding of rockfish taken incidentally when targeted cod or flatfish. This incidental value was 4.5 tonnes in the winter, when only the larger vessels in the fleet could operate, and 3.0 tonnes from April through September, when the larger vessels were fishing Pacific hake, and the smaller trawlers were fishing the other groundfish.

The very existence of regulations so numerous and complex, solely to stretch the fishing season through the year, indicates that the fleet had not been kept well matched to stock productivity. By the mid 1990s a portion of the industry was lobbying for IVQs to allow further rationalisation of the trawl fleet. Neither the fleet nor the government was able to converge on a consistent view of whether ITQs were a desirable direction for this fishery however. In the fleet, a number of new, business-oriented owners bought licenses and vessels, and began to cultivate high-value, low-volume markets. Their success was paralleled by the processors, who took advantage of resource and legal crises in the US to enter new markets for high quality fresh and glazed products. These markets wanted reliable supply, which in turn made some of the processors and new operators both lobby for ITQs. Many of the most experienced license holders opposed ITQs however, believing they could benefit more from an Olympic-style fishery, particularly with the regulations to spread out the fishing season. The union also opposed ITQs, fearing a concentration of harvesting and loss of jobs. Within the government, a number of key individuals in regional Fisheries Management supported ITQs as a way to simplify management an increasingly complex fishery. However, the national level, there were important pockets of opposition to ITQs, fearing precedents would be set for other fisheries with important social roles.

This impasse might have continued for many years, had there not been a major crisis in Pacific salmon and Atlantic groundfish in the 1990s.This led to a major release of government funding for restructuring, and an opportunity for fisheries to come forward with their own proposals for fleet reduction. The Groundfish Development Authority was created with joint membership by industry, Management, and Science. After extensive consultation, between 1997 and 1999 it facilitated introduction of both an industry-funded license retirement program and a conversion to IVQs (individual vessel quotas, with transferability details to be worked out) throughout the fishery. By 2001, the fleet was down to approximately 70 active vessels, with only two vessels larger than 30 meters.

The Groundfish Development Authority went quite far in terms of overhauling the entire approach to the industry. A number of their innovations will be presented in the section on the Institutional Component of Sustainability, as the industry took on responsibility for many aspects of its governance, and the government moved into an audit role on the effectiveness of their stewardship programs. However, the economic benefits of the management changes are quite apparent. Between 1991 and 2001, the value of rockfish landings by the BC trawl fleet increased from approximately 12 million dollars (Can) to over $ 37 Million, whereas the volume of landings decreased from over 21 000 mt to under 17 000 tonnes (although several more species of rockfish were landed in 2001). For some key species, price per kg when delivered to the market had increased nearly an order of magnitude, due to increases in quality for more specialised markets.

Not only was the economic performance of the fishery greatly improved, but the industry had assumed a significant portion of the management and research costs. Again, some details will be presented in the Institutional Component portion of this report. However in 1991, the industry paid the government $100 per year per license in fees. In 2002, industry bore $3.65 MILLION in direct costs for management of the fishery. Moreover, ten percent of the TAC of every species went into a special pool, with the revenues from the pool being used to fund specific projects to improve the knowledge base for science or management of the resource.

Throughout the history of this fishery, international trade issues were rarely a focal concern. A variable but always large percentage of the processed rockfish was exported, almost exclusively to the US and Japan. Both trading partners have been quick to protect their trade interests, and challenge practices thought to interfere with WTO approved trade practices. The land-in-Canada policy for rockfish is an exception to this generalisation, but that practice, too was modified with the implementation of IVQs. The presence of 100 percent observer coverage has meant that accurate catch records are assured wherever product is landed, but changing economics in the US industry has also made landings outside of Canada less attractive.

Direct subsidies were also never an issue in this fishery. Because of its relatively minor stature in the political agenda of BC, it never had the leverage to attract direct government support. As a year-round, profitable fishery, few participants took advantage of the special provisions for seasonal fishermen in the Canadian unemployment insurance policies. These UI provisions have been challenged as a significant indirect subsidy in some trade disputes (as well as a major contributor to unsustainability in some other fisheries), but are not a factor in the BC rockfish trawl fishery. If anything, the issue has been the relatively great economic wealth that has been centralised in a very small sector. (One of the more successful skippers in this fleet reported, off the record, that each of his five regular crew-hands had received well over $120 000 annually between 1992 and 1997 in crew shares, and the fishery has increased in value since 1997).

With regard to keeping illegally caught product from reaching markets, several factors always worked in favour of close regulation of landings. With such a small fleet, a system of daily hails has been mandatory since the 1980s, and it actually worked well. Each licensed vessel had to radio into a Fisheries Management office prior to leaving port, start destination and the species it was seeking. Once on the fishing grounds it had to hail in daily with location and catch by species. With many enforcement vessels at sea for much of the year, dealing with the much larger fisheries for salmon, Pacific hake (summer) and herring roe (spring), encountering enforcement vessels and suffering opportunistic inspections were always a threat to the skippers. Likewise, few ports had the facilities for unloading groundfish, and only three plants had processing facilities, so monitoring of catch at those ports was also feasible and effective. Penalties for failure to hail in accurately were not terribly great, but cases were slow to court and skippers were prevented from fishing while charges were being handled. This was a strong incentive to comply with the regulations on accurate reporting of landings. (These measures were no deterrent to discarding, of course, but that was addressed elsewhere.)

By 1995, even before the IVQ system was implemented, a program of 100 percent dockside monitoring was established. This required all vessels fishing groundfish to hail into a Fisheries Management office at least 24 hours before returning to port, and informing the managers which of eight (later 10) designated ports in intended to land at to unload its catch. All vessels were met by a dockside monitor, who oversaw unloading of the catch. The dockside monitoring program was 100 pecent cost recovered.

With implementation of the IVQ system, the dockside monitoring program was augmented by 100 percent at-sea observer coverage, also at 100 percent industry expense. This program was intended to deal primarily with prevention of discarding a high-grading when trying to meet the many species-specific IVQs, but effectively ensures no rockfish harvested by the licensed trawl fleet enters the market illegally. Vessels without trawl licenses cannot carry trawl gear on deck, so the system probably is highly effective.

2.4 Institutional component of sustainability

Does the organization (national/regional/provincial government and or regional fishery management organization) responsible for fishery management understand that its main institutional aims are to use the best scientific information (on resources, the environment, the ecosystem, on social and economic factors, including traditional knowledge, the collection and dissemination of statistics, the evaluation of the cost effectiveness, efficiency, and socio-economic effects of alternative management measures, and the revision or elimination of inefficient or useless measures); to apply the precautionary approach to conservation and management; to do monitoring, control and surveillance, in their areas of jurisdiction but also for those vessels flying their flags on the high seas or of foreign vessels using their ports; to co-operate with other States and other RFMOs to promote conservation and responsible fishing, and to resolve dispute peacefully; to implement transparent decision making process and involve interested parties; to promote the awareness of responsible fisheries through education and training; and to duly take into account the interest of their fisheries in planning the multiple use of coastal areas.

What concrete actions substantiate that the organization does / does not understand its main institutional aim?

Best scientific information (on resources, the environment, and the ecosystem, on social and economic factors, including traditional knowledge: In the BC rockfish fishery, scientific information on the resource was used as fully as possible from the outset of Canadian management. As explained in the section on the resource, rockfish can only support very low exploitation rates. In the 1980s, although rockfish were known to be long-lived, their ages were underestimated, and the target exploitation rate was too high, leading to overly optimistic scientific advice. One of Canada's (possibly globally) first large scale planned experiments on harvesting specifically designed to improve the estimate of a sustainable exploitation rate was conducted on a BC rockfish stock (Leaman and Stanley 1993). Unfortunately for sustainability, as knowledge accumulated and was applied to decision making, the progressively lower target exploitation rates made the TAC-based management more and more vulnerable to errors in estimating the stock biomass to which the exploitation rate was applied.

Consequently, research in the 1990s shifted to improving biomass estimates. BC rockfish became the test case for developing state of the art age-structured population analyses, taking account of errors in abundance indices and ageing (Richards and Schnute 1992, Schnute 1994, Schnute and Richards 1995). They also became the objective of fully co-operative industry-Science survey efforts, to augment the limited capacity of the government research lab to conduct surveys. These went far beyond just using an industry platform for conducting surveys. Industry knowledge was used to formulate hypotheses that had not occurred to the scientists, and to design novel ways to test those hypotheses (Rice 1998, Stanley and Rice 2003). Some of these efforts have led to primary publications with vessel skippers as co-authors with DFO biologists (Stanley, Mose, *et al.* 2001), a level of use of traditional knowledge with few precedents in fisheries.

Traditional knowledge was not used in the survey context. In addition to the advisory process described in the "openness and transparency" section, by 1994 an official working group of industry, Science and Fisheries Management was functioning. Formed initially as a forum for discussing areas of disagreement, starting with the 1994 Management Plan, there was an agreement that the landed value of the overages allowed by the aggregate management approach would go into a research and management fund. This removed any incentive for individual fishers to abuse the overage allowance, but gained industry support for directing the revenues directly back into "their" fishery, rather than government coffers. Both industry and science and management could propose projects to be supported by this fund. Science got to screen the list for scientific merit and tractability, with unilateral authority to remove (providing justification) any proposals considered silly or impossible. Of the remainder, industry had the right to select the project that would proceed in any year.

This initiative was so successful that it was taken up quickly by the Groundfish Development Authority as it restructured management of the entire groundfish fishery between 1997 and 1999. The Groundfish Development Fund now not only receives overages when they occur due to overruns of IVQs, but also receives ten percent of the TAC of every stock. Research projects are solicited, reviewed, selected and overseen by a Board comprised of industry, science and management, with industry holding a majority. This clearly demonstrates the value placed by industry on advancing knowledge about their resources, and the acknowledgement by the Department that industry can fill the role of a full and equal partner in advancing knowledge.

Not only is the science done, it is used in management. Information is adequate for analytical assessments of fewer than ten of the more than 17 species that are harvested commercially. For the species for which data and biological knowledge is adequate, though, since 1985 assessments have been done and then peer-reviewed by the Groundfish Subcommittee of Pacific Science Advisory Review Committee, which provided harvest options to the Regional Fisheries Management Executive Committee. A consultation process (described below) followed afterwards, but with only a few exceptions within the past 20 years, all TACs have been set consistent with the scientific advice from PSARC.

All the above developments addressed the biological and ecological aspects of the resource. Although Fisheries Management hired a resource policy/economist in 1992 and again in 1994 to work on the groundfish trawl fishery, neither stayed in the position long enough to complete a thorough review of the social and economic components of the rockfish fishery. Hence, until Fisheries Management and the industry formed the Groundfish Development Authority, and the Authority itself began to contract economic studies, there was little factual basis on which develop social and economic strategies for this fishery. Since the GDA has been functioning, most of the attention of the economics research has been on fleshing out the details of the IVQ system. Among the products of work so far are estimates of reasonable caps on the percentage of the quota that could be allowed to be accumulated by one license holder, and estimates of an economically based scaling factor for trading of IVQ shares of different rockfish species among license holders. The results of both of these studies were taken up directly in the 2001 and onward Groundfish Trawl Management Plan.

The collection and dissemination of statistics has been a part of this fishery since it came under Canadian jurisdiction. Initially this was through sales slips issued by the processing plants, which reported landed catches by species. Port samplers, taking length composition and otoliths for assessment purposes, were also working in the processing plants. Co-operation was so good that two of the plants actually provided office space for the port samplers, so the individuals would not have to transport equipment records back and forth to the workplaces. As enforcement of trip limits and species quotas of rockfish became more important, the hail system and dockside monitoring programs were implemented. On-board observers were introduced in the mid 1990s, initially meeting substantial opposition from the fleet, both for cost and for the inconvenience of carrying another person under cramped conditions in the smaller trawlers. With the restructuring that came with implementation of full IVQ fisheries, the smallest vessels largely retired from the fleet. The remainder carry observers on all trips. The combination of full dockside monitoring, full observer coverage and significant level of catch sampling mean that collection of statistics is complete for this fishery. Dissemination has always been done through annual reports of official fishery statistics by Fisheries Management and in PSARC reports by Science.

Through the 1990s, significant effort was invested by industry, Science, and Fisheries Management to find measures that would be effective in matching harvesting to the differential productivity of the many species taken in the rockfish fishery. The extensive series of meetings occurred, initially informally, then through a working group established by Science and the trawlers' association, and finally through a formally constituted Groundfish Development Agency, entrenched in the fishery's Management Plan, have been described above. Efficiency of alternative measures from a biological perspective was investigated through simulations conducted by Science. Results of analyses were presented to PSARC on multiple occasions. Cost-effectiveness and impact on efficiency from the industry perspective was evaluated by the industry, probably in largely unquantitative ways, although one of the processing companies, deeply involved in these discussions, had clear and quantitative indicators of the benefits of being able to provide a reliable, high-quality product to market. The first efforts by Fisheries Management to evaluate administrative efficiency were incomplete, but by the mid 1990s, an individual in Fisheries Management was conducting formal analyses of the management overhead.

As results of these various initiatives became available, they were presented to and discussed by the Groundfish Trawl Advisory Committee. Minutes of those meetings record the sequence of recommendations, many leading to incremental changes in successive Management Plans through the decade. Recommendations did not always support the cost efficient alternatives, and the annual Management Plans did not always act on all the GTAC recommendations. Nonetheless, over the 1990s the Management Plans became incrementally more complex. The sequence was usually that provisions were added to address concerns about biological sustainability of the mixed-species harvesting. Because of the strong working relationship of Science and the processing sector, such measures were usually ones that, although often resulting in reductions in volume of catches, would result in more stability of harvesting, and hence also improved economic performance of the fishery. However, commonly within a year or so measures would be added to address compliance issues with the biologically-based measures. Rarely were any measures dropped, once they were included in the annual Management Plans.

The evolving complexity of the Management Plans through the 1990s was one of the drivers the consolidated industry support behind IVQs, as opponents in the industry found the regulatory web more and more difficult to operate within. Government, too, found enforcement more and more difficult, so opposition from within some key positions in government (based primarily on concerns about precedents that might be set for other fisheries, rather the appropriateness of IVQs in the rockfish fishery) also weakened.

The transition to IVQs between 1997 and 1999 provided an opportunity to overhaul the Management Plans systematically. The ones since 2000 are hardly simple, but the classes of measures are at least well co-ordinated to achieve the goals of the fishery. Measures that were ineffective were discontinued, but there is still some concern that redundancy persists, particularly between the dockside monitoring and ob-board observer programs. Each has a different focus, but some argue that with only modest adjustment the observer program could make the dock-side monitoring program unnecessary.

Revisions to this fishery commenced when the precautionary approach to conservation and management was still in early stages of development. However, some aspects of the precautionary approach were foreshadowed by the developments in the rockfish fishery, even if the early attempts look a bit naïve with today's knowledge and experience with the application of precaution in fisheries. By the early 1990s, the Management Plans always began with a clear statement of objectives for the fishery, which is a fundamental tenet of the precautionary approach. Although individual goals were a bit general and as a suite some often were vulnerable to pointing in incompatible directions, the goals stand up pretty well as Objectives within the Precautionary Approach (Table 2). These goals were augmented in the mid 1990s by the results of a PSARC Working Group on Biological Objectives, which addressed the issue of objectives for biologically objectives systematically across all stocks and fisheries in Pacific Region (Rice *et al.* 1995). The groundfish Management Plans, covering the rockfish fishery, were among the first to formally pick up the results of that work in the list of goals stated in their Management Plans.

Even though the analytical assessment methods were poor at handling analytical uncertainty in the early 1990s, this was one of the first fisheries in Canada where scientific advice from PSARC at least designated Low Risk, Medium Risk, and High Risk harvest options (PSARC reports). As the analytical methods to address uncertainty improved (see the section on assessing status of the resource) the biological basis for the Low, Medium, and High Risk options improved, whereas the form of advice remained much the same. By the end of the 1990s PSARC ceased providing High Risk options in its advice, and the likelihood that Fisheries Management would select the Low Risk option was much higher than earlier in the decade.

Although Science continues to explore biological reference points for these stocks (CSAS Proceedings), the identification of Limit and Precautionary/Buffer Reference points for these highly mixed-stock fisheries is proving challenging. Formal reference-point based management is still a desired goal for this fishery, but it is not expected in the near future, as some multi-species aspects of such an approach remain to be worked out. The multi-species issue is not one of adding dynamics attributable to predator-prey relationships or environmental regimes to the reference points (problems being investigated in a number of centres around the world). Rather the reference points must address the mixed-species harvesting with differential knowledge and different productivities among the species, and only partial ability of the fleet to target selectively with the multi-species complexes. Similar problems plague application of reference-point based management to mixed stock salmon fisheries, and are proving similarly difficult in those applications. The solutions that offer the highest protection to the least productive stocks forego very large amounts of yield from more productive stocks, and are considered highly inefficient.

Many of the governance and consultation aspects of the Precautionary Approach have been dealt with in preceding sections, or will be covered in the following treatment of transparency of decision-making. However, there have been industries Advisory Committees formally recognised and supported by the Department for over 20 years. With implementation of the Groundfish Development Authority, a tri-partite board now has a great deal of scope to develop and implement Management Plans and strategies for the rockfish fishery. The Minister of Fisheries and Oceans retains final authority to approve all management measures, but in practice industry is becoming significantly empowered in these fisheries.

The various programs to monitor fishing activities, control catches, and conduct surveillance have been described in other sections of this test, because their lack of effectiveness was a major driver in revisions to this fishery. Surveillance was always relatively straightforward in this fishery, because of the small number of vessels that were licensed to participate. The daily hail system, with at opportunistic at-sea surveillance by the multi-purpose Fisheries Management fleet, was sufficient to know who was fishing where and when for most the past two decades.

Knowing what amounts of which species of rockfish were being caught was not nearly as straightforward. The commitment of government to monitor and control catches was never in doubt; it was simply a matter of finding effective tools. The purchase slip system, supported by port monitoring proved effective at monitoring landings at a modest cost. However, it provided no information about at-sea discarding and dumping of catch overages, and self-reporting of such practices in vessel logbooks was never considered reliable.

As discussed earlier, it took most of the 1990s to develop a program of at-sea observers that gave full coverage throughout the rockfish fishery. For a time in the mid 1990s, not only was there a program of partial observer coverage, with complex rules for allocating observers to vessels, but Science regularly conducted comparative analyses of landings of vessels with and without observers. Discrepancies were taken of evidence of discarding. These analyses were never strong enough to support charges of illegal practices (discarding of any species under quota was illegal, if its retention might have put a vessel over its trip limit) when charges were contested in court. However, they became justification of allocating observers to future trips of vessels whose species or size composition differed from that of vessels fishing nearby and carrying observers.

With implementation of the IVQ system in this fishery, there is full observer coverage and dockside monitoring of every vessel. This gives an extremely high degree of monitoring and control of catches, with all costs of the program (including program administration) borne by the industry. The effectiveness is complemented by regulations that prohibit discarding of any catch other than a small number of prohibited species, where practices must be in place to maximise likelihood of live release of the prohibited species. The industry was given from 2001-2003 to trade bits of their IVQ quota shares of different groundfish species, including rockfish, so each skipper can match his roster of TACs to his particular interests and skills at catching different species. From 2003 onward, exchange of shares will be much more difficult. This difficulty, combined with prohibitions on discarding any rockfish covered by any of the aggregate IVQs (including a category of "Other rockfish" which includes essentially all species currently of commercial value) will be the true test of the effectiveness of the monitoring and control of this fishery. Industry is expected to find ways, on its own, for each license holder to take his TACs for each rockfish aggregate, through fishing as selectively as practical, and taking advantage of modest overage tolerances (with compensatory subsequent reductions), but without any discarding.

Since extension of jurisdiction in 1978, international fishing fleets have never been an issue in this fishery. The continental shelf is so narrow along the BC coast that trawlable habitat ceases well within Canada's EEZ. The Canadian fleet has consistently operated with the Canadian EEZ, except in a very small number of planned experiments in high seas fishing for completely different species or stocks. These experiments have always included taking biological observers from DFO Science, and registering fishing plans with Fisheries Management. Therefore, the international behaviour of the Canadian rockfish fleet is unlikely to be a conservation issue.

There have been very occasional cases of United States fishing vessels from Washington State or (more often) Alaska crossing the international boundary and fishing in Canadian waters. Such events have been rare, however, and Canadian and United States officials generally co-operated effectively on deterrence measures.

There are several seamounts much further offshore, where international fishing could be more of an issue. Like the other experimental fishing events discussed above, visits by the BC rockfish fleet to the seamounts have always carried biologists and been planned with Fisheries Management. Co-operation between the fleet and government was extremely high as the harvesting potential of the seamounts was explored. Intervention of environmental activists into these planned experiments led to a story which has important lessons, but is a side issue to the theme of this report.

There are also issues to do with trans-boundary rockfish stocks, exploited by both US and Canadian fisheries. Assessment of stock status has long been done co-operatively. The two countries have followed somewhat different approaches to rockfish management, but the differences were not large enough make complementary management impossible. However, major difficulties in the United States, stemming from tendency for litigation of fisheries management measures in the United States courts, has presented the United States management system with challenges that slowed greatly their own efforts at conservation. Stocks shared with Canada have suffered, of course, but these institutional problems in the United States cannot be solved by Canadian management initiatives. The only short-term option for Canada is to adjust harvesting as stock status changes in these shared rockfish stocks, and that has been done consistently.

The relatively small size of the BC rockfish fleet made the Groundfish Trawl Advisory Committee, created following extension of jurisdiction, and effective mechanism for involving the industry in management of the fishery. Through the 1980s and early 1990s is was nearly the sole forum for industry input to management, and functioned solely as an advisory body. GTAC was chaired by Fisheries Management, although industry did get to select its representatives. Annual results of stock assessments were presented to GTAC, discussed, and industry views on management options were presented. Fisheries Management would then take the results of the assessments, advice of GTAC, and develop a draft Management Plan each year. The draft Management Plan was presented to another meeting of GTAC for their consideration, but modifications, if any, were solely the prerogative of Fisheries Management.

Through the 1990s, industry was given many more fora in which to participate. Most have been mentioned in earlier sections: the Science – industry working group evolving eventually into the Groundfish Development Authority. The GDA is still formally an advisory body, in that according to Canadian law, decision-making authority lies solely with the Minister of Fisheries and Oceans. In practice it exercises a great deal of autonomy in allocating the funds made available through the ten percent quota allocations to the GDA, plus overage revenues. GTAC remains a consultative body, but through its executive is much more actively involved in development of the annual Management Plans. A subcommittee of GTAC, the Groundfish Special Industry Committee provides specific advice on the IVQ program. These committees and subcommittees, all officially recognised in the Management Plans, give management of the rockfish trawl fishery a very open and transparent framework for decision-making.

The PSARC Groundfish Subcommittee also includes industry members as full participants. They are able to table information, share in review of all assessment documents, and are part of discussion leading to consensus advice on harvest options and other measures. In a few cases they have been authors or co-authors of PSARC documents themselves, and on others, industry or the GDA has contracted independent technical experts to prepare materials for PSARC review.

The Code of Conduct for Responsible Fishing has a special place in management of the groundfish trawl fishery (including rockfish) in BC. Another ten percent of the quota of each species is reserved as Code of Conduct Quota. It is allocated as increments to each vessel's IVQ, on an annual basis; conditional on each vessel's rating on the provisions in the Code of Conduct with regard to fair treatment of the crew and safe vessel operation. The GDA conducts the vessel ratings, so industry itself is fully involved in the criteria used and judgements made on compliance with the industry's Code. This makes education and training of all license holders and their crews with regard to provisions and practices of responsible fishing a very high priority.

Multiple uses planning for coastal areas are in its infancy in Canada, but are being developed as Canada's Ocean Act is implemented. The experimental initiatives that are being tried on the BC Coast have focused heavily on near-shore areas, where the trawl industry has long been prohibited from operating, in order to avoid sectoral conflicts with other fisheries. Hence developments in the rockfish trawl fishery have largely been outside of multiple uses planning in coastal areas.

There are not yet any precedents for how the interests of this fishery would be treated when they do become incorporated into one or more of the integrated coastal zone planning initiatives. However, the integrated planning initiatives under Canada's Oceans Strategy have been widely inclusive, and community groups, environmental advocacy organizations, and sport fish interests have been well represented. Trawl fisheries are very unpopular with all of those groups, and there is pessimism that their interests will receive sympathetic hearings in discussions. In the near future, it is likely that the industry will continue to seek measures with create clear boundaries between areas of operation of fisheries currently included in the integrated coastal zone management planning initiatives (salmon fishing, inshore commercial hook-and-line fisheries) and avoid these fora. This strategy will not be viable in the long run, as integrated coastal planning initiatives begin to consider offshore hydrocarbon exploration and development of an integrated chain of Marine Protected Areas. Before they are brought into such planning exercises, an investment in educating other participants in the integrated planning fora, with regard to the conservation measures and economic value of the trawl sector would be wise.

3. WHY IS FISHERY MANAGEMENT SUCCESSFUL (OR NOT)?

3.1 Inappropriate incentives

The incentive structure contributed significantly to biological unsustainability of the rockfish fishery through the 1980s and 1990s. Particularly many of the original participants in the fishery were committed to a competitive, Olympic-style fishery, and indeed were comparatively the better competitors in the fishery. Rockfish fishing is not easy and experience does matter.

The price differential among rock species presented additional incentive for unsustainable behaviour. Wasteful fishing practices, when viewed in the context of all the species in the rockfish assemblage, would earn higher financial payoffs per unit of fishing effort than more responsible ones. On an ecosystem scale sustainability remains a challenge even under the IVQ system, where species with little market value are merely lumped as "Other rockfish". Without the presence of full observer coverage even the IVQ system would not provide an incentive for responsible fishing with regard to such species.

This fishery has never had a prominent role in social well-being of coastal BC. It had few participants, but the jobs provided were stable and considered among the better opportunities in all the BC fisheries. Neither the earlier competitive fishery nor the current IVQ system places the creation of employment as a priority, although the Code of Conduct includes several provisions to ensure those jobs that are created are safe. Implementation of the IVQ system and a fleet reduction initiative that would have occurred even without the IQ system, reduced employment by nearly 40 percent, but the absolute numbers of jobs lost is not great enough to create serious social upheaval. The value of this fishery is creating an economic elite within the entire fishing sector of BC, but Canada has chosen this option for many of the smaller fisheries in BC as a conscious policy choice. It has opted for high-profit margin fisheries in a number of cases, and in parallel passed over to the fishery financial responsibility for many research and management costs. Some measures have always been in place to prevent over-centralisation of the fishery in too few hands, although unlike on the East Coast of Canada, there was never a legal or policy prohibition on processors owning licensing, so there was some vertical integration of harvesting and processing. Under the IVQ system, licenses cannot be stacked, and there are caps on the percentage of quota of any species that can be held by any one license. These measures are expected to maintain the current level of employment in this fishery.

Incentives for economic sustainability have improved greatly under the IVQ system. When the fishery was fully competitive, much of the landed product was of less than optimal quality, and supplies were undependable. Plants had difficulty remaining viable, and the management costs of trying to control wasteful fishing practices were much greater than the Department was willing to invest in management. In even the first phase of the IVQ system, when assemblage management was in place, trip limits were in place for all the more marketable species so harvesters had to maximise quality of their landings to increase revenues. As processors could contract regular supply of fish to the best markets, price per kg increased for the best species from $0.32 per pound to $2.12 (1995 to 1997 prices, according to confidential data from the major processing plant.). The rockfish trawl fishery seems to be responding to the economic incentives of IVQ management much as textbooks say fisheries should. Moreover, the program was developed with checks on some of the potential abuses of

IQ fisheries built into the overall management plan. These checks include the limits on the percentage of quota that one license can acquire, and full observer coverage to deter high-grading at sea.

Institutional sustainability has also improved under the IVQ system. Consultation was always reasonably strong in management of the rockfish fishery. The IVQ system included a tri-partite (industry, Science, Fisheries Management) Groundfish Development Authority, with resource-supplied funding to promote good stewardship practices and innovation in the fishery. Industry and Fisheries Management both participate in the Science-based assessment review and advisory processes. Industry actively supports Science, and the fishery provides much of the cost of management and research. Together, these arrangements provide numerous positive incentives for the stability of the institutions involved in conservation and management of the BC rockfish resource and fishery.

3.2 High demand for limited resources

Because of the colours of the fillets of most species of rockfish and their distinct, “un-fishy” taste, rockfish was always a valued product in the fish trade. In the 1990s demand grew even more as the “white-tablecloth” market for fresh or fresh-glazed rockfish developed in the US, and Japanese importers developed methods for getting fresh or individually glazed whole rockfish to Japanese markets. The high demand in the face of low productivity of rockfish stocks, combined with their common (but not universal) tendency to aggregate densely in at least parts of the day and the mixed species catches, worked strongly counter to biological sustainability. However, the same demand meant that the fishery had the potential to generate enough value to provide an economically viable fishery; a potential largely realised even before the IVQ measures supported even great economic benefits from the fishery. The combination of high value, high demand, and high revenues, combined with very limited participation, has produced a very stable fishery, with stable institutions. All participants see clearly how maintaining the value of the fishery depends crucially on maintaining the current institutions, particularly the GTAC, GDA, and the Code of Conduct Subcommittee of GTAC. The fishery does very well on this measure, with the high demand and low availability of rockfish a crucial factor in keeping harvesters, processors, Science and Fisheries Management all committed to making the institutions work effectively.

3.3 Poverty and lack of alternatives

Entry costs (vessel and gear until the late 1990s, and then very high purchase costs for a license and quota as well) into the trawl fishery were always so high that it was never viewed as an absorber of unemployment in BC, and significant wealth was needed to enter. This is not true of the salmon fishery or even the inshore hook-and-line rockfish fisheries (prior to implementation of limited entry in 1992). Dealing with social and economic unsustainability in those fisheries created numerous problems in BC, many of which persist today. However, at no time were there attempts to export displaced fishers from those fisheries into the rockfish trawl fishery. At the same time, as the trawl fleet was reduced from 142 licenses to under 75, the amount of displaced labour, although large in percentage for this fishery, was small in comparison to unemployment created by downsizing in the salmon fishery and BC forestry. Programs created to deal with unemployment from those sources disguised, if not solved, any possible social issues stemming from changes in the groundfish trawl fishery.

3.4 Complexity and lack of knowledge

Complexity and lack of knowledge both contributed significantly to biological unsustainability of this fishery. Lack of knowledge was manifest both in terms of the appropriate target exploitation rate for these stocks, and the actual biomass to which the exploitation rate (if known) should be applied. Knowledge is now adequate to set target exploitation rates for these species; a few individually and reasonably for rockfish as a group. However, knowledge of absolute biomass levels remains inadequate, and although assessment tools used now deal much more effectively with uncertainty about biomass, they do so at a cost of estimates thought to be highly conservative. To Science this is a necessary property of the assessments, and consistent with the precautionary approach. To industry, this may be depriving them of substantial catch that they could be taking safely were biomass estimates better. They take this seriously enough that currently (winter 2003) they are exploring the feasibility of conducting, with Science, a comprehensive, coast-wide multi-species biomass survey of all the commercially important rockfish, at industry expense (Starr and Schwartz 2000).

Aside from lack of knowledge, the complexity of what is known about the rockfish resource presents significant challenges to biologically sustainable fisheries on these species. Productivity does vary among species, distributions overlap but do not coincide perfectly across species (even at the scale of "inshore", "shelf" and "slope"), and harvesting of single species is impossible (not just with trawls but with any gear). These biological complexities mean that even with greatly improved knowledge of absolute biomasses of all commercial species, optimal harvesting of the species complex will be difficult to guide with Science advice and achieve with management (or co-management).

The biological uncertainties and complexities map onto management of the resource, and achievement of social and economic sustainability, in the typical ways. Where lack of knowledge made advice inaccurate, and the advice was implemented, the status of the resource was impaired by over-fishing. This led to subsequent decreases in harvesting, and concomitant loss of economic benefits. Where Science advice became increasingly conservative to accommodate a growing appreciation of the uncertainty in the estimates of population size and productivities, again economic returns were reduced.

The mixed-species nature of the rockfish trawl fishery also added complexity to management. Management tools that would allow multiple targets to be hit more or less simultaneously by the fishery were hard to identify, and harder still to implement. The measures greatly increased the costs of managing the fishery and the costs of going fishing, both effects working counter to economic sustainability. Moreover, the complexity created at least the opportunity, and from the industry perspective essentially the need, to adopt wasteful fishing practices, by discarding and high-grading to keep a single trip limit from terminating fishing trips with much unused hold capacity and many under-subscribed species-specific trip limits. These reactions to regulatory complexity increased economic inefficiencies in the long term through wasted catch, and ecological unsustainability through resultant excessive fishing mortalities on the stocks. The complexity also had a positive feedback effect on uncertainty, because bringing more and more species under increasingly restrictive trip limits created the possibility of ever-greater discarding and misreporting. This made the catch data even more uncertain, reducing the information that the catch data contained about both stock status and the consequences of management measures.

Complexity and uncertainty did not seriously undermine faith in the institutions. Although there was a certain degree of distrust among the three main parties (industry, Fisheries Management, and Science) as institutions, the numbers of individuals involved in the three sectors was small enough that personal relationships, with personal trust, existed among all parties. (Interestingly, perhaps, the port samplers, who were Science Branch biologists with only modest job classifications but daily contact with the vessel crews, plant operators, and enforcement officers, had a focal role as trusted points of communication on particularly difficult or delicate issues.) Although complete candidness was not always possible in formal settings such as advisory body meetings, individuals from all three parties readily agreed on where the problems lay, and shared a determination to find workable solutions.

3.5 Lack of governance

Governance was rarely considered an issue in this fishery. As noted in the preceding paragraph, there were few enough individuals involved in the Science, Fisheries Management, and industry sectors, that people trusted (or distrusted) each other as individuals, not as spokespersons of anonymous institutions. Although industry often questioned the results of scientific assessments, or the feasibility of measures proposed by Fisheries Management, they never questioned the legitimacy of Science or

Fisheries Management to undertake such activities. Likewise, the industry was small enough to be moderately cohesive. This may be best attested by industry itself reporting (privately, but effectively) individuals who were particularly flagrant in using wasteful fishing practices. The highly participatory governance systems of GTAC, GDA, and the Code of Conduct Subcommittee of GTAC are all strongly supported by all three parties.

This general trust and faith in governance may not be stable if, in future, new groups are given a legitimate role in the groups specified above. In particular, some radical environmental groups are challenging the ecological sustainability of any form of trawl fishing, and a number of groups are promoting establishment of networks of large marine no-take reserves. So far dialogue on these considerations has not been an important part of governance of the BC rockfish trawl fishery. However, the current governance arrangements would not accommodate all the groups interested in such a dialogue without major changes. These could bring serious governance challenges to the forefront, either from industry if these other groups are given some leverage in decision-making regarding their fisheries, or from the environmental and community groups, if they are denied any role in such decision-making.

3.6 Interactions of the fishery sector with other sectors, and the environment

The rockfish fishery is a part of the larger ground fish fishery, but the interactions are well structured between individual license holders focusing on the multi-species rockfish fishery, and those focusing more on Pacific hake, Pacific cod, or flatfish. There are special IQ fisheries for Pacific halibut and sablefish, which are managed separately under different Management Plans. Fixed sharing agreements of the total sablefish TAC, and a prohibition of retention of halibut have existed for many years. The sectors often accuse each other of failure to comply with the letter (or spirit) of the agreements. However, the measures necessary for the rockfish trawl fishery to comply with the sablefish sharing agreement, and to minimise halibut by-catch mortality are considered neither a major impediment to biologically sustainable operations nor an important driver towards economic unsustainability.

Likewise, a number of species are taken both by the inshore hook-and-line rockfish fishery, and the trawl fishery. Sharing percentages were worked out years ago on the basis of catch composition, and have been stable for some time. Allocating some portion of the total allowable catch of species such as yellow eye rockfish mean that the starting TAC for the rockfish trawl fishery (with or without IVQs) is lower that it would be otherwise. However, the species for which there are sharing agreements have rarely been the most problematic in managing the multi-species fishery or conserving the resources.

To this point, offshore industries other than fishing have had essentially no impact on the groundfish trawl fisheries. There has been a moratorium on offshore hydrocarbon exploration and all undersea mining, and shipping channels are well-defined. Industry can avoid the shipping lanes and still have wide scope to harvest the full TACs. As noted under the governance section, however, these positive situations may change in the future. The TACs are low enough, however, with or without an IVQ system, that it is highly likely that the rockfish fishery can continue to harvest its TAC even with a network of MPAs and some offshore hydrocarbon exploration.

Although it is not another sector, in 2002 Canada passed its first Species-at-Risk Act. This Act includes measures that make it illegal to kill, harm, or harass any species classified as Endangered, unless one has an Incidental Harm Permit, or is operating in compliance with a Recovery Plan approved by the competent national or provincial jurisdiction (in the case of rockfish this would be DFO). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has adopted only a slightly modified version of the IUCN criteria for assessing risk of extinction; a set of criteria whose appropriateness for marine fish has been challenged (FAO 1999). COSEWIC addressed its first Status Report on a Pacific rockfish in the Fall 2002, designating Bocaccio as Threatened. Bocaccio have never been an important component of landed catches, and are one of the 15 species included in the "Other Rockfish" IQ allocation.

At the Threatened level of risk conservation measures and a recovery plan are necessary, but fisheries taking Bocaccio as an incidental catch can continue. However, many more species of rockfish could be assessed by COSEWIC, and it is likely that of the more than 30, at least a few might qualify as Endangered on the COSEWIC / IUCN criteria – although none are believed to be at any risk of biological extinction. If any are listed, the effects on the economic sustainability of this fishery are unknown. Although the Minister of Fisheries and Oceans could issue Incidental Harm Permits to all rockfish license holders, he can only do that if it can be demonstrated that the resultant by-catch will not compromise achievement of rapid recovery of the listed species. (A "reverse burden of proof", justified with the Precautionary Approach). Given the biology of rockfish, rapid recovery of small populations will be very slow, even with zero by-catch, so it is unclear if the Act would allow Incidental Harm Permits to be issued under such circumstances. This is presently unknown territory for government and industry, but an area of great concern with regard to sustainable fisheries and conservation.

With regard to interactions with the environment, the long life and low natural mortality makes conservation and management of rockfish not greatly affected by short term or even decadal-scale environmental variability. Few rockfish species have produced strong year-classes in the past two decades, and the lack of recruitment is certainly leading to scientific advice for reductions in harvests – advice that is now being taken in almost all cases. However, analyses of age composition data from a variety of sources suggests that some species may have produced only three strong year-classes in the century preceding the first intensive fishing in the 1950s. If that is true, the absence of any strong year-classes in 20 years is not an exceptional event.

4. HOW CAN THE DIFFICULTIES AND OBSTACLES BE OVERCOME?

Is it true for this fishery that the main problem with sustainability is not the lack of instruments, but the lack of implementation of existing instruments?

This statement is partially true. The most serious problems with economic sustainability and some of the most serious problems with biological sustainability were addressed through existing instruments. The two important ones were altering the economic incentives in the fishery through individual quotas, and improving the enforceability of a complex system of individual vessel quotas through full at-sea observers and full dockside monitoring. Other problems of biological sustainability were addressed through improved analytical assessment methods which did a better job of including uncertainty in scientific advice, and adoption of more risk averse management, consistent with applying the Precautionary Approach in management.

All of the changes were possible because through the period of change the fishery was characterised by relatively good communication among industry, Science, and Fisheries Management. A formal consultation mechanism was already in place and as the economic incentives were changed, additional processes were implemented that increased the transparency of decision-making, and industry's role in actual decision-making. Had an attitude of some trust and shared acknowledgement of the major drivers to unsustainability not existed in all parties, progress on the changes to incentives in the fishery probably would have been slower and possibly not viable at all.

The measures used to address the most serious problems in biological and economic sustainability appear to be working, although the IVQ system is too new for firm conclusions to be justified. However, it was only possible to implement the measures in the BC rockfish trawl fishery because social and institutional sustainability were not at issue in this case.

The workforce employed in this fishery was reduced by over 1/3, and further reductions may be possible. Had this fishery been a major employer, even on a local scale, instead of a comparatively small component in the much larger, salmon-dominated view of commercial fisheries in BC, this impact would not have been acceptable to society or government. The huge problems encountered by the commercial and recreational salmon fisheries through the 1990s distracted attention from the major reductions in the groundfish fishery, and may have even made it more possible to obtain Policy support for some innovations.

As it was, two of the three major rockfish processors sold out their interests in all groundfish, consolidating large scale processing in one company. The impact of this quasi-monopoly on processing was mitigated, however, by a number of harvesters going into small-scale processing and marketing of their own catches, changing the processing sector of the entire fishery. Again, the changes are too recent to know if, in the long term, the diversified small-scale processing and marketing is going to be viable.

The other favourable precondition was that rockfish are a high-value fish, at least if handled and marketed well. The institutions necessary to support the IVQ fishery are complex and costly to administer, as are the observer and dockside monitoring program. Nonetheless, rockfish produce enough value that the industry can be billed for the entire costs of these initiatives, providing more than $3.5 Million annually for the core programs. Had this been a lower value fish product, the institutional framework to support the biological and economically sustainable measures could not have been supported without major inputs of government revenues. It is unlikely that the government would have supported such a small employer at a high cost.

4.1 If there are instruments missing, what are they?

The key instrument still missing is the ability to assess so many different stocks accurately, and to manage harvests optimally in such a complex fishery. The current tendency is to become increasingly precautionary with regard to the major target species of rockfish, and be willing to forego potentially sustainable current yield to increase confidence that yields will persist in the longer term. However, this is a strategy with obvious limits, and only works because there is no pressure form society or government to increase or sustain jobs in this fishery. It is also highly vulnerable to just one or a few species experiencing particularly strong recruitment. With what is known of species mixing at sea at present, an increase the TAC and, correspondingly, effort, for those species experiencing strong recruitment would have a very high risk of increasing fishing mortality on other rockfish not experiencing the marked increase in biomass.

The biological sustainability of this fishery also remains particularly vulnerable in the "other rockfish" aggregate. These are the 15 or more rockfish species not targeted individually, but also nearly impossible to avoid when fishing the more major aggregates. It is only faith that supports the belief that the "other rockfish" categorisation offers any protection to the constituent species, and there is almost no analytical basis for determining what quantity of removals are sustainable for any of the species in the Other Rockfish aggregate. Changes in market conditions could always prompt selective fishing within the complex, almost certainly causing overfishing of the species becoming favoured in the markets. Science has almost no chance of acquiring sufficient information about biomass and productivity of the "other" rockfish stocks to allow determination of sustainable harvest levels for these stocks, even though catch monitoring is now reliable. This may not be a missing instrument but it is missing knowledge, and a missing capacity to acquire and apply sufficient knowledge. Determined opponents of trawl fishing could exploit this weakness at any time to use the new Species-at-Risk Act to bring the entire mixed-species fishery to a halt.

There were also no formal instruments to deal with the loss of employment when the IVQ system was implemented. Rather, the reduction in employment was so small that on the provincial and national scales it became masked by the much greater reductions in the salmon fishery and forestry. Based on its track record in Atlantic groundfish and Pacific salmon, Canada has shown little ability to deal effectively with social disruptions caused by reductions in fisheries that were important regional or local employers.

How could the paths to solutions identified in the Bangkok Workshop (allocation of Rights; transparent, participatory, management; support to science; enforcement; planning; benefit distribution; integrated policy; precautionary approach; capacity building and public awareness building; and market incentives) help to overcome the difficulties and obstacles to successful implementation of fishery management.

The changes to improve the biological and economic sustainability of this fishery made great use of a number of the paths to solutions that were identified in The Bangkok Workshop. A brief commentary on the role of each with a subjective evaluation of its importance to allowing improvements in this fishery on a scale of -10 [major step backwards] to 0 [no role] to +10 [major contributor to improvement] follows.

Allocation of Rights (+10). This is a core change. It was the greatest contributor to improved economic sustainability, and a major contributor to improved biological sustainability.

Transparent, Participatory Management (+8). Existence of some transparency and participatory governance at the start of the restructuring of the fishery was a precondition to any progress. Making the fishery institutionally sustainable through paying the major costs for administration and monitoring required much more movement on this path.

Support to Science (+6). An important contributor to improved biological sustainability. Lack of knowledge of species biology and resource status for all the nearly twenty harvested species is currently considered the biggest single impediment to further progress on biological and economic sustainability. Industry is particularly strong in its support for more science, and is willing to contribute beyond the $3.5 million plus ten percent of all TACs that is already contributed to science and management, to support more science projects that they consider urgent priorities.

Enforcement (+9). The 100 percent at-sea observer and dockside monitoring programs were essential to progress on biological sustainability. They were necessary preconditions to allow the changes to incentives that improved economic sustainability.

Planning (+6). Planning has always been a strong point in this fishery. It improved with more participatory management. Success of the IVQ system requires very advanced planning, linked to decision-making and management actions.

Precautionary Approach (+5). An important component in improving biological sustainability of this fishery. Approaching a situation where more and more precautionary interpretations of stock status and complexity are becoming a threat to economic sustainability in the short term.

Market Incentives (+4). Direct market incentives in the form of eco-certification, for example, played no role (yet) in this fishery. However, the much higher value markets that were found for rockfish in the 1990s made three important contributions to improved sustainability. One was an increase in the willingness to trade off volume of catch for stability of supply, which reduced opposition to implementation of IQs. The second was simply getting the harvesters and processors thinking positively about change; they saw first hand that their condition could get better without just catching more fish. They also saw the need for industry and government to work together. The third was that the fishery was capable of generating the revenues needed to support the infrastructure necessary for institutional sustainability.

Capacity Building and Public Awareness (0). The industry made some use of consultants it hired on its own, but most of the initiatives on the industry side came from skippers and plant operators themselves. The rockfish fishers were widely considered a skilled elite in the BC fishing community, and were agents of innovation themselves. Many individuals worked closely and effectively with Science and Fisheries Management, as did the industry organization – the Deep-Sea Trawlers Association. Little capacity building was needed, and the changes would probably have been slower to come had a great deal of effort been spent attracting public awareness. Opponents to trawl fishing are increasing in number and profile in many places, including Canada. Calling attention to the creation of a stable, viable trawl fishery on a long-lived, slow-growing species might have resulted in a great deal of external intervention in the discussion leading to change.

Integrated Policy (-5). The first two times that attempts were made to explore major changes in the rockfish fishery, intervention by broad-ranging policy experts stalled efforts. The fishery was a small and comparative cohesive group, where change was easy relative to change in many of the larger and higher profile fisheries of Canada. Innovation was opposed by the policy sector on the basis of fears that changes in this fishery would be considered "premature precedents" that would create unattainable expectations in other fisheries. In a similar vein, late in the planning for the transition to the IVQ system (about 1998), the new departmental Sector was created with a specific mandate for integrated coastal zone planning. Some officers in that new Sector tried to delay any major changes in this fishery, pending creation of "integrated planning boards", whose nature in 2003 is still being discussed. Had the Department and industry waited for integrated planning processes to be implemented, change would still be many years in the future.

Benefit Distribution (-7). Over a third of the participants in harvesting and processing lost their opportunity for employment. The fishery paid the immediate costs of the vessel and license retirement programs, but not follow-on support for displaced workforce. In general the overall tax system of Canada is the only tool by which benefits from this fishery are redistributed to those no longer employed. For the successful skippers, their crews, and the better processor/marketers, they are considered to be getting major personal economic benefits from the IVQ system.

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Pacific Groundfish Trawl Integrated Fisheries Management Plans 1990 to 2003 (Annual). Recent ones are available at http://ops.info.pac.dfo.ca/. Earlier ones can be requested by email at the same site.

Scientific Advisory Documents from PSARC (Pacific Science Advisory and Review Committee [before 2000 Pacific Stock Assessment Review Committee]) are available at http://sci.info.pac.dfo.ca/PSARC

Research Documents containing the more detailed assessments are available electronically from the DFO Canadian Science Advisory Secretariat website: http://www.dfo-mpo.gc.ca/csas. Recent documents of particular interest include:

99/16, 99/53, 99/58, 2000/154, 2000/155, 2000/156, 2000/172, 2000/173, 2001/136, 2001/138, 2001/139, 2001/148. Documents from the November 2002 assessments are expected soon.

Proceedings of PSARC Groundfish Subcommittee meetings are also available on the CSAS website: http://www.dfo-mpo.gc.ca/csas. Recent ones of interest include 98/19, 99/32, 2000/25, 2001/34, and 2002/27.

Table 1: Annual TACs (tonnes) and, where applied, Trip Limits (tonnes unless designated otherwise) for rockfish, as set in annual Fisheries Management Plans.

Species	1992A	1995B	2002C
Pacific Ocean Perch	4 050 11.3; 5.0	Aggregate 2 - 7,320 t 30 000/15 000 (pounds)	5 847 (5%)
Yellowtail rockfish	4 800 13.3; 9.1	Aggregate 1 - 8,880 t 25 000/12 500;	4 422 (5%)
Yellowmouth Rockfish	1 380 5.0; 4.5	Aggregate 2	2 365 (5%)
Canary Rockfish	1 275 4.5; 4.5	Aggregate 1	1 046 (4%)
Silvergray Rockfish	1 575 4.5; 4.5	Aggregate 1	1 187 (4%)
Redstripe rockfish		Aggregate 2	1 521 (5%)
Widow Rockfish		Aggregate 1	2 316 (5%)
Rougheye Rockfish		Aggregate 3 - 700 t 20 000/10 000	530 (7%)
Shortraker Rockfish		Aggregate 3	105 (7%)
Shortspine/longspine Thornyheads		Aggregate 3	736 / 405 (10%)
Yelloweye rockfish			0trawl (4%) 7 hook & line
Quillback, Copper, China and Tiger rockfish			0 trawl (4%) 5 hook & line
All other rockfish		Aggregate 4 - no TAC 20 000/10 000	

A: For 1992, the TAC was divided into quarters in the ratio 30: 29: 21: 20 percent. For trip limits (lower numbers in each cell, first number is trip limit for 1st and 4th quarters, second number is for second and third quarters. Within any quarter, once 70 percent of the TAC was attained for a species, the respective trip limit would fall to 3.0 tonnes

B: For 1995, the TAC for aggregates 1, 2, and 3 were divided equally into quarters. Vessels could choose one of three options for each quarter, with two trips at the Option A limit (listed in cell), four trips at the Option B limit (listed in cell), or an unlimited number of trips at 2 500 lbs per trip. Within each quarter, when 70 percent of the aggregate TAC was taken, the trip limit would drop by 50 percent. When 90 percent of the TAC was taken, trip limits for any aggregate would fall to 10 000 or 5 000 lbs. For Aggregate 3, the 700 tonnes TAC applied only to Rougheye Rockfish, but the trip limit to all species in the aggregate.

C: The number in parenthesis is the maximum TAC share that can be acquired by any single IVQ holder.

Table 2: Selection of Management Objectives relevant to the rockfish trawl fishery as listed in the annual Management Plan for BC groundfish. Where comparable, they are matched by theme rather than presented sequentially as in the annual Management Plans.

1993	2002
To ensure the conservation and protection of groundfish stocks in the Pacific Region through the application of sound scientific and management principles.	To ensure conservation and protection of the various groundfish resources through the application of management principles applied in a risk averse and precautionary manner based on the best scientific advice available.
	To continue to apply specific conservation measures for [individual] stocks when required.
To ensure the optimal use of groundfish stocks in order to meet the social and economic objectives of the people of Canada.	In accordance with its commitment to providing opportunities for First Nations to access Pacific groundfish for food, social, and ceremonial purposes, Department will continue to provide opportunities for First Nations to harvest for these purposes …
	To provide opportunity for the commercial trawl sector to harvest groundfish while employing adequate controls and monitoring …
	Continue to develop further measures necessary to fulfil Fisheries and Oceans Canada's overall mandate …
	Provide opportunities for recreational harvest of groundfish year round using management measures such as daily catch limits and daily possession limits.
To ensure utilization of groundfish stocks over the entire calendar year where possible.	To provide opportunity for the commercial trawl sector to harvest groundfish … through the continued use of the IVQ management approach ….
To implement no trip limit (other than sablefish which is less that 2.3 t, to reduce at-sea dumping and quarterly over-runs.	
To aggregate species wherever appropriate and permitted by regulation while ensuring some form of protection for all constituents of the aggregate.	
To develop a credible industry-funded catch monitoring program in designated ports of landing. And To take positive action in reducing at-sea discarding of commercially valuable groundfish. through:	… adequate controls and monitoring in the commercial fishery to ensure commercial TACs are not exceeded. This will be achieved through …… at-sea observer coverage, and DMP [dockside monitoring] of all commercial landings
	To develop and improve industry measures in 2002/2003 season to improve utilisation of catches and reduce wastage.

appropriate incidental trip limits closures when and where necessary c) introduction of a prohibition on rockfish dumping at sea.	To account for mortality of all species in the commercial groundfish trawl fishery. The Department has established various target levels of mandatory observer coverage on vessels …
	To ensure trawl license holders are held individually accountable for keeping their catches within the allocated IVQ holdings
Coastwide closures will be avoided where conservation of stocks and reduction in waste allow. If harvest rates threaten the continuity of the fishery, then local closures or reduced fishing effort will be the primary techniques to extend the fishery.	
	To initiate consultation with industry, other stakeholders, and First Nations, on future measures aimed at developing a more comprehensive and integrated approach to the overall management of groundfish resources … that will promote responsible fishing and management practices. To develop mechanisms to support the research and management of the groundfish fishery during 2002/2003. The longer-term vision is to move towards industry supported arrangements with arms-length representative groups/organizations.

DISCUSSION PAPER 6

LARGE VOLUME DEMERSAL FISHERY IN THE NORTH ATLANTIC

by

J.-J. Maguire[92]

Summary

Large volume demersal fisheries have been conducted for centuries in the North Atlantic, being one of the main reasons for the colonisation of North America by Europeans. Fisheries science and science – based fishery management can be said to have originated in this area for the management of large volume pelagic and demersal fisheries. Yet, despite its long history and the large investments in fishery science and in fishery management, most large volume demersal fisheries in the area have severely overexploited the resources and stocks are seriously depleted. None of the fishery management systems reviewed can be described as achieving sustainability under any of the four components of sustainability. It is hypothesised that an exclusive focus on the bio-ecological component of sustainability may be at least partially responsible for the failure of fishery management in the area.

1. INTRODUCTION

An International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries was held in Bangkok, Thailand from 4 to 8 February 2002 ("the Bangkok Workshop") in the context of an FAO/Japan Government cooperative programme initiated in 2001 to address issues related to factors of unsustainability and overexploitation in fisheries.[93] Case studies of the management of a number of typical fisheries are to be reviewed in a second workshop to be held in Mauritius in February 2003. This review of large volume demersal fisheries in the North Atlantic was prepared in this context.

After describing the characteristics of large volume demersal fisheries in the North Atlantic, the success of fishery management under four components of sustainability (bio-ecological, social, economic and institutional) is evaluated, and reasons for the success or failure of fishery management are proposed.

2. DESCRIPTION OF LARGE VOLUME DEMERSAL FISHERY IN THE NORTH ATLANTIC

Large volume demersal fisheries are at the root of western modern fishery science and science – based fishery management. Bottom trawl predominates, but various other types of towed (Danish and Scottish seines) or fixed (gillnet, set lines, hand lines) gear may also be used. Vessels range from relatively large vessels towing bottom trawls, to nearshore open deck handlining or fixed nets vessels. Large volume demersal fisheries can be more or less single species (hake off South Africa/Namibia), but there are few examples in the North Atlantic and most should be considered multispecies. Because several sectors (based on the gear fished, on the geographical base, or on nationality) are present in the fisheries, the allocation of resource between the various sectors is source of conflict.

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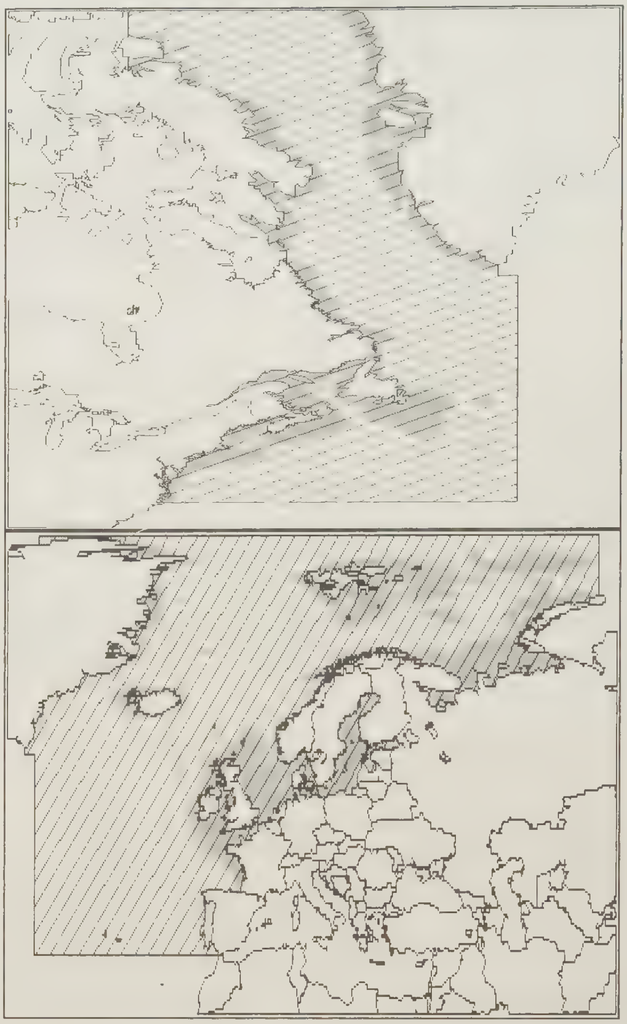
[92] The views expressed in this paper are solely those of the author, J.-J Maguire, Consultant, Sillery, Quebec, Canada, jjmaguire@sympatico.ca

[93] Project GCP/INT/788/JPN, FAO Fisheries Report No. 672, FIPP/R672.

The large volume demersal fisheries examined take place in FAO Statistical Area 21, the Northwest Atlantic and in the Northeast Atlantic (FAO Statistical Area 27) (Figure 1). The archetype demersal fishery takes place in the North Sea, but fisheries with similar characteristics also occurs off Greenland, the Faroe Islands, Iceland, Norway, Canada and the USA.

Modern fisheries science can be said to have originated in this area in the late 1800s (Smith 1988) while active science-based fishery management was implemented from the 1960s. Steam trawlers were introduced in the late 1800s and bottom trawling has generated the large volumes of the titles since the early 1900s. Trawlers are of various sizes (from less than 10m to more than 30m). Other gears, gillnets, longlines, and various forms of seining (Danish, Scottish) contribute smaller volumes to total landings.

The species of most interest are cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*), but whiting (*Merlangius merlangus*), pollock/saithe (*Pollachius virens*), hake *(Merluccius* spp), plaice (*Pleuronectes platessa, Hippoglossoides platessoides*), sole (*Solea solea)* and various other species are also caught.



- Figure 1: FAO Statistical Area 21,North West Atlantic and 27, North East Atlantic

In the Northeast Atlantic, all countries fishing in the area, except Norway, Iceland and the Faroe Islands, belong to the European Union who has responsibility for fishery management. The Faroe Islands, Iceland and Norway have their own EEZ and they have bilateral agreements with the European Union. Of the eight countries having a coast on the North Sea, only Norway is not a member of the European Union. Norway and Russia have joint management of the fisheries harvesting resources they share. Iceland, Canada and the USA do not have serious problems with overlapping jurisdiction.

The main management measure is Total Allowable Catches (TACs) sub-allocated to countries and/or individual fishing enterprises, sometimes in the form of Individual Transferable Quotas (ITQ), except on the Faroe Islands where Individual Days at Sea are allocated. Other management measures include gear and mesh limitations, as well as closed areas and seasons. Scientific advice for fishery management is provided through peer review processes whose openness varies from very open in the USA, to almost completely closed in the International Council for the Exploration of the Sea who provides advice to the EU, Norway, Iceland and the Faroe Island. The Canadian scientific advisory process is intermediate between that of ICES and that of the USA. Stock assessments and scientific advice are on a single species basis, although scientific advice may take into account the fact that the fisheries are exploiting several species at the same time.

A similar ranking of the decision making process can be made, with the most open system (the Regional Fishery Management Councils) being found in the USA, the most hermetic one in the EU, with processes in Canada, the Faroe Islands, Iceland and Norway less elaborate and giving more discretionary powers to the Minister in charge.

In the EU, TACs are distributed to the different participating countries according to a fixed allocation key. Within each participating country, the sub-allocation of the national quota varies. Some countries have officially adopted ITQs, others have implemented systems which essentially amounts to an ITQ system without the name (Goodlad 1999), while still others function in a more or less competitive fishery. Various national arrangements have been set up to ensure that the national share is indeed caught in order to protect the national position.

All countries enjoy a relatively high standard of living with diversified economies where fishing account for a small portion of GDP or of government revenues, albeit fishing may be locally important to regional economies.

A more complete description of the fishery management system in the North Atlantic can be found in Maguire (2001).

3. IS FISHERY MANAGEMENT SUCCESSFULLY ACHIEVING THE FOUR COMPONENTS OF SUSTAINABILITY?

3.1 Bio-ecological component of sustainability

All fishery management organizationss in this area understand that that their main bio-ecological aim is to protect, conserve, and restore fishery resources and that overfishing should be prevented. The need to protect, conserve, and restore the environment, the habitat, the ecosystem and bio-diversity; is similarly understood in theory, but the focus on single – species fishery management means that in practice there is few concrete actions in those areas. Except in the USA, little attention has been given to the Maximum Sustainable Yield (MSY) concept, and nowhere is MSY interpreted in the context of multispecies and ecosystem considerations in any applied way.

All fishery management organizationss in this area explicitly recognise that conservation of fishery resources is their main objectives and all try to follow scientific advice as closely as possible. The fishery management decision – making process in the EU, whether because of its structure or because of its history, does not tend to favour conservation: National Ministers are seen to have caved-in to the European Commission (EC) when they adopt the EC proposals without changes (Holden 1994). Despite this apparent flaw in the decision – making process, the fishery management proposals made by the European Commission have generally either followed strictly the ICES advice, or been more restrictive. Furthermore, the decisions made by the Fisheries Council since the early 1990s have been close to the Commission's proposals, and therefore consistent with the scientific advice provided by ICES. This has implied severe cuts in quotas and the imposition of additional management measures to reduce fishing mortality on overfished stocks, including drastic reductions in days at sea for some sectors in 2003 (EC 2002).

Although it can be confidently stated that the Fisheries Council understands that its main objective is to protect and conserve resources, it would be difficult to argue that it has been successful. Of the principal demersal fishes harvested in the North Sea, cod, plaice, sole and whiting are outside safe biological limits while haddock is harvested outside safe biological limits (i.e. fishing mortality is too high). In addition, fishing mortality on cod is so high that it is expected to lead to the collapse of the stock (ICES 2002). The failure of the European Common Fishery Policy (CFP) is acknowledged in official documents such as the Green Paper on the Reform of the CFP (EC 2001), the European Commission proposed reform (EC 2002a) as well as in public statements by Commissioner Fischler (2002).

The successful rebuilding of Northeast Arctic cod at the end of the 1980s has been heralded has a hallmark of Norwegian fishery management. Much less has been made of the substantial revision in stock status in 1997 and the continued low biomass of Northeast Arctic cod since then. Northeast Arctic cod is currently outside safe biological limits with fishing mortality estimated to be at or above that leading to the collapse of the stock (F_{lim}) and the agreed TACs have been in excess of the scientific advice since 1998. The agreed TAC of 395 000 tonnes for 2002 is more than two times higher than the ICES advice of less than 181 000 tonnes (ICES 2002).

Icelandic cod is a mainstay of the Icelandic economy. ITQ management has been introduced in the early 1980s, and the system is deemed to have reached a satisfactory equilibrium in the early 1990s. Following extensive bio-economic simulation modelling, a formal harvest rule was introduced in the mid 1990s. Initially, biomass increased and the harvest rule was applied strictly. The 1999 assessment implied a decrease in the TAC and the harvest rule was adjusted. Although safe biological limits have not been defined for Icelandic cod, fishing mortality is estimated at about $F = 0.8$ in 2001, one of the highest in the time series since 1955 and twice the target of about $F = 0.4$, and spawning stock biomass is in the lowest 35th percentile for the time series. Bio-ecological sustainability is cannot be said to be achieved for Icelandic cod.

The Faroe Islands' economy also depends heavily on fisheries. TAC management was introduced in the early 1990s as a condition requested by the Danish government to financially save the Faroese banking system. The TAC management system was introduced but not accepted by the fishing industry and substantial misreporting of catches and landings ensued. The Faroese government, on the recommendation of a joint working group including industry, fishery science and fishery management, implemented a system based on transferable (within gear categories) days at sea. The new system appears to have solved the data quality problem, but fishing mortality on the main demersal species remains high, particularly on cod. The management system also includes relatively large closed areas. Nevertheless, it is doubtful that bio-ecological sustainability is being achieved given the high fishing mortality on the main species. Biomass, however, does not show sustained downward trends and apparently continues to fluctuate within normal limits.

Of the seven cod fisheries entirely or mostly under Canadian jurisdiction (defined by the North Atlantic Fisheries Organization (NAFO) Divisions or Subdivisions they occupy: 2J3KL, 3Ps, 3Pn4RS, 4T-4Vn (Nov-Apr), 4Vn (May-Oct), 4VsW, 4X), all were closed to fishing in 1992-1993 except that on the southern Scotian Shelf and in the Bay of Fundy (NAFO Div. 4X). Small scale fisheries were re-opened in the Gulf of St. Lawrence in 1997 (3Pn4RS and 4T-4Vn (Nov.-Apr.) after initial signs of some rebuilding. Both fisheries may be closed again in 2003 because of a lack of growth in the stocks. Some inshore components of the 2J3KL cod stock complex appear to have grown somewhat, but the large offshore components remain severely depleted, as do cod stocks in 4Vn (May-Oct) and in 4VsW. Surprisingly, the cod resource in 3Ps does seem to have recovered while the biomass of cod in 4X remains very low and fishing mortality is higher than the target. Most other groundfish in the Canadian area remain depleted, except haddock and yellowtail. Fishing mortality was reduced to $F = 0.10$ or less for most cod stocks, but there is an apparent increase in natural mortality with total mortality remaining relatively stable despite the closure of the fisheries. Bio-ecological sustainability is therefore not achieved for Canadian demersal stocks.

The USA New England Fishery Management Council (NEFMC) implemented drastic management measures on groundfish starting in 1994-1995. These included an approximate halving of the allowable days at sea and the permanent closure of large areas where logbooks from commercial vessels showed high catch per unit of effort. These measures have successfully reduced fishing mortality on most groundfish species, with haddock and yellowtail in particular showing substantial increases in biomass. Similar to waters to the north however, cod biomass appears to have been less responsive to decreased fishing mortality. Bio-ecological sustainability may have been achieved for some of the groundfish fisheries in the area of the New England Fishery Management Council.

3.2 Social component of sustainability

Fishery management organizationss in this area are mostly concerned with the bio-ecological component of sustainability. The other components of sustainability are either less explicitly expressed, or not expressed at all. Optimum utilisation of the resource, when explicitly addressed is pursued mainly in a conservation (i.e. bio-ecological component of sustainability) context through mesh size regulations and protection of juveniles. The provision of safe, healthy and fair working conditions is generally the responsibility of an agency outside of the fishery management process. Diversification of income was seen as an objective of fishery management in the 1970s in several parts this area, but since the mid 1980s, it has taken a back seat to the protection of the resource. The European Union, Norway and Iceland have aid components in their fishery management framework, but in other countries, fisheries aid to developing countries is the responsibility of government institutions not part of the domestic fishery management process.

In the European Union, the recent agreement on the reform of the CFP (EC 2002) does include a component to help enterprises and communities affected by the reduced fishing opportunities. In addition, the proposed reform states that it aims at achieving sustainable fishing communities and profitable fishing enterprises. However, recent actions suggest that the social and economic components of sustainability are subsidiary to the bio-ecological one which has clear precedence: the message from the European fishery management authorities seems to be that bio-ecological sustainability will be achieved whatever the social costs.

No specific governmental documentation in English on the social objectives of fishery management in Norway, Iceland, or the Faroe Islands was found. In Canada, a major policy document of the early 1980s (Kirby 1982) identified bio-ecological, as well as social and economic objectives in fishery management but they were neither quantified nor prioritised. They were therefore not helpful in making decisions in fishery management. When it closed the cod and other demersal fisheries in the early 1990s, the Canadian government paid monetary compensations to fishermen and fish plant workers affected by the fishery closures. This can be interpreted as an effort to ensure the sustainability of fishing communities.

However, with the severe budget cuts of the mid 1990s to bring the Canadian deficit under control, the Canadian Department of Fisheries and Oceans (DFO) re-focused itself on three main objectives for fishery management: Conservation, conservation, conservation (page 1 of the Minister message DFO 1999), i.e. and exclusive focus on the bio-ecological component of sustainability. Despite this explicitly exclusive focus on the bio-ecological component of sustainability, the actions of the DFO speak differently. The allocation of highly valuable shrimp and snow crab quotas to a large number of fishermen in the Newfoundland Region suggest that the DFO bureaucracy continues to pursue socio-economic objectives. However, it would be difficult to assert that the social component of sustainability is successfully achieved considering the inequities that continue to exist in several fishing communities where some fishermen involved in highly lucrative invertebrate fisheries make hundreds of thousand dollars (Canadian) while groundfish fishermen are essentially without income from their traditional fisheries.

In the USA, the Sustainable Fisheries Act (SFA) of 1996 specifies 10 national standards that fishery management plans must satisfy.[94] National standards 8 and 10 relate to the social component of sustainability. They can be summarised as follows.

> 8. Consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to:

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[94] See http://www.nmfs.noaa.gov/sfa/magact/mag3.html#s301.

a) provide for the sustained participation of such communities, and
b) to the extent practicable, minimize adverse economic impacts on such communities.

10. Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

The USA SFA therefore includes a social component of sustainability and the New England Fishery Management Council includes a Social Sciences Committee to advise it on the socio-economic implications of the management measures it considers implementing. The USA National Marine Fisheries Service does employ some social science scientists, including sociologists and anthropologists who participate with academic colleagues in the NEFMC Social Sciences Committee. Social considerations, however are secondary to bio-ecological ones as the rank in the listing of the 10 national standards indicate. A further indication is the revision of biological reference points that took place in March 2002 (NMFS 2002). As a result of the revision, target biomasses were substantially increased for several stocks with a resulting call for further substantial cuts in the fishery even though stocks were rebuilding, and sometimes approaching the "old" target biomasses, under existing management measures.

Although the social component of sustainability is explicitly included in the legislation of some jurisdictions, the overall perception is one where the bio-ecological component of sustainability has clear and complete precedence. The prevailing expectation in fishery management circles is that as fishing units become more and more efficient the number of fishing units will need to be progressively reduced (or their activity curtailed) in order to protect and conserve the resources. The forecast is for a continued decreased in the number of people involved in fishing as technological innovations and modernisation continues.

3.3 Economic component of sustainability

Almost all fishery management organizationss in the North Atlantic are acutely aware that their main economic aims are to match fishing capacity to the productive capacity of the resources. Various decommissioning schemes, buy-back programs as well as the implementation of ITQ programs do testify that the fishery management organizationss are trying to reduce excessive fishing capacity. Conducting trade according to the World Trade Organization (WTO) rules, including preventing illegally caught fish (that is fish caught in IUU (Illegal, Unreported and Unregulated) fisheries) from reaching their markets is also generally understood as an objective of fishery management. It is not universally clear that the elimination of subsidies is also one of the main economic aims of fishery management, but it is difficult to find reliable information on this subject.

Generally speaking, there is considerably less information available on the economic component of sustainability than on the bio-ecological one. Updated stock assessments are made on a regular basis, and these are readily available on the internet:

- http://www.ices.dk/committe/acfm/comwork/report/asp/acfmrep.asp for stocks in Europe (including the Faroe Islands, Norway and Iceland);
- http://www.dfo-mpo.gc.ca/csas/Csas/English/Publications/Stock_Report_e.htm for stocks in Canadian waters;
- http://www.nefsc.noaa.gov/nefsc/saw for stocks in US waters.

Information on the economic aspects of fishery management, particularly in terms of the economic performance of individual fleets is more difficult to access. In Europe, the European Commission has encouraged and financed several economic studies through its FAIR funding mechanism. At least some of those studies have been used to elaborate the EC's proposal for the reform of the CFP, but it is not obvious that there is a mechanism to update the studies on a regular basis and that the results are effectively used routinely in fishery management decision – making. Nevertheless, the turmoil created by the fishery management measures adopted for 2003 suggest that the economic impact of the TAC reductions will be large on at least some fleets. For example, a large proportion of the Scottish demersal fleet submitted decommissioning bids in 2002, and indication that several fishermen were not optimistic for the future.

A brief search on the web did not yield any source of economic information for the Faroe Islands, Norway or Iceland. There were reports in 2001, however, that the ITQ system in Iceland was leading to high-grading, i.e. discarding of the less valuable portion of the catch in order to maximise the landed value of the available quota. This behaviour was occurring particularly by those enterprises that had to buy additional fishing quotas to operate. Given the paucity of information found on the economic component of sustainability, no conclusion could be reached on whether it was achieved or not.

3.4 Institutional component of sustainability

If persistence is an indication of sustainability, then institutions of fishery management in the North Atlantic are sustainable. However, the Analytical Framework for the preparation of this review demands more than simple continued existence:

> *"Does the organization (national/regional/provincial government and or regional fishery management organization) responsible for fishery management understand that its main institutional aims are to use the best scientific information (on resources, the environment, the ecosystem, on social and economic factors, including traditional knowledge, the collection and dissemination of statistics, the evaluation of the cost effectiveness, efficiency, and socio-economic effects of alternative management measures, and the revision or elimination of inefficient or useless measures); to apply the precautionary approach to conservation and management; to do monitoring, control and surveillance, in their areas of jurisdiction but also for those vessels flying their flags on the high seas or of foreign vessels using their ports; to co-operate with other States and other RFMOs to promote conservation and responsible fishing, and to resolve dispute peacefully; to implement transparent decision making process and involve interested parties; to promote the awareness of responsible fisheries through education and training; and to duly take into account the interest of their fisheries in planning the multiple use of coastal areas."*

None of the fishery management systems in the North Atlantic has been designed to address the complex problems they are currently facing (Cunningham and Maguire 2002). They have evolved from relatively organizationss involving few people to the current elaborate processes involving a large number of people. All the fishery management processes reviewed understand that the best scientific information should be used, but this is generally limited to the "best information" on the status of each individual stock. Information on the environment, the ecosystem and social and economic factors, including traditional knowledge, is no where regularly used in the assessment or the fishery management processes. In addition, very few of the management processes in the area seem to have a real appreciation for how good the "best scientific information" really is with the result that stock assessments are often given more importance in the fishery management process than what their reliability would justify.

All fishery management processes do collect and disseminate statistics on landings and some measure of fishing effort. Where TAC management systems are in place however, landing statistics are not believed to be reliable because of misreporting by species or areas and catches are even less reliable because of discarding for regulatory or market reasons. The stock assessment methods used in the North Atlantic depend heavily on the availability of reliable catch information. The fishing industry knows that, and it also knows how unreliable the catch statistics are. As a result, the credibility of the scientific advice suffers.

The fact that fishery management systems have evolved progressively over time rather than being the result of a "grand design" results in considerable resistance to change. This means that although the cost-effectiveness, the efficiency and the socio-economic effects of alternative management measures may sometimes be evaluated pro forma, they are rarely given serious consideration. Most interested parties have sufficient investment in the current system to prefer small changes to the existing unsatisfactory system than the large unknowns that a completely new system would bring. In Canada, the fisheries law dates from early in the twentieth century. It has been amended and modified numerous times, but the basic text cannot be considered an adequate basis to face the current challenges of fishery management. It seems particularly difficult to eliminate inefficient or useless measures.

The bio-ecological component of the precautionary approach (PA) was quickly implemented in the North Atlantic. ICES was one of the first international organizationss to adopt it and by 1998, ICES provided advice on all stocks in the context of a precautionary approach. The EU and national governments that receive advice from ICES generally responded well to the advice and have themselves adopted the concept of the PA. NAFO also quickly adopted the PA. The USA Sustainable Fisheries Act is a textbook implementation of the PA while Canada is somewhat lagging in its implementation of the PA. It had only recently begun identifying reference points for a few fish stocks.

The efficacy of monitoring, control and surveillance (MCS) seems to vary considerably from one fishery management system to another but there are few systems where it can be considered entirely satisfactory. A recent report from the European Commission (EC 2002b) suggests that there is scope for considerable improvement of MCS in EU member countries. The suspected poor reliability of catch and landing statistics in the European Union is consistent with poor MSC. Anecdotal information suggests that MCS in Norwegian waters in considerably better: EU fishermen with access to Norwegian waters through bi-lateral agreements do not dare breaking the regulations because there is a high probability that they will be caught. Despite the importance of the fishery to the Icelandic economy, the existence of an advanced and elaborate management system, including MCS, there were reports that the ITQ management system was leading to high-grading, where only the most valuable specimens of the allocated species are kept while the others are discarded dead. In Canada, the most recent assessment for Bay of Fundy cod did not provide estimates of biomass because landings are suspected to substantially underestimate the real catches (Clark 2002). It therefore seems that there are severe implementation problems in almost every fishery management system of the North Atlantic, possibly with the exception of Norway.

The transparency of decision – making and the involvement of interested parties varies considerably in a counter clockwise manner with the least transparency and smallest involvement of interested parties occurring in the European Union management process and the most transparent and largest involvement of interested parties occurring in the USA. In the Eastern North Atlantic, scientific advice is provided by ICES through a process that is not open to outside scrutiny while the decisions by the EU Council of Ministers are made behind closed doors. In contrast, the scientific and decision – making processes in the USA are completely open to whoever wants to participate. The transparency of the fishery management system in Canada is somewhere in between.

Similar to monitoring, control and surveillance, education and training in responsible fisheries seems to vary from jurisdiction to jurisdiction, but it cannot be described as fully satisfactory in any of them. There are private initiatives by fishermen's organizationss on both sides of the Atlantic, but these have mostly to do with using appropriate gear rather than dealing with the full scope of the FAO Code of Conduct for Responsible Fisheries. In fact, in some cases, fishery management organizationss are discussing responsible **fishing** rather than responsible **fisheries**. Consequently, they see the code as relevant to fishermen's behaviour, but not to their own.

The need to protect the interest of the fisheries in planning the multiple uses of coastal areas is increasingly recognised. However, fisheries often occur in the less developed areas of the countries bordering the North Atlantic where the any economic development activity is actively sought. It therefore remains difficult to protect the interest of the fisheries when activities such as oil exploration and exploitation are considered.

Overall, fishery management institutions in the North Atlantic appear to be almost exclusively concerned with the bio-ecological component of sustainability. TAC is a main conservation tool and scientific advice is the determinant factor in determining TACs and most other management measures. Monitoring, control and surveillance, particularly in terms of estimating the amounts caught and landed, is inadequate (at least it is believed to be so by a large number of interested parties) which undermines the credibility of the scientific advice. Decision-making in several jurisdictions is far from transparent, which further undermines the credibility of the entire system. Although fishery management institutions do continue to exist, it is difficult to describe them as being sustainable.

4. WHY IS FISHERY MANAGEMENT SUCCESSFUL (OR NOT)?

Fishery management in the North Atlantic cannot be described as being successful. In the North East Atlantic, several stocks are considered outside safe biological limits (ICES 2002), employment in the sector is steadily decreasing (EC 2001), the poor state of demersal resources combined with expensive management approaches threaten the survival of many fishing enterprises, and the institutional make up is not conducive to making decisions that are promoting sustainability.

Fishery management is not more successful in the Western North Atlantic. Off the Canadian coast, several important groundfish resources have collapsed in the early to mid-1990s and most remain depleted despite severe restrictions on the fisheries.[95] The bio-ecological sustainability has therefore not been achieved as far as demersal resources are concerned. Concurrently, the biomass and TACs of high priced crustaceans species, including snow crab (*Chionocetes opilio*) and shrimp *(Pandalus borealis*) have increased markedly. Given the management system in place, few demersal fishermen have been able to take advantage of the increased biomass and TACs, while snow crab and shrimp fishermen are making record profits. This does not help social harmony in small communities where wealthy snow crabs and shrimp fishermen live next door to nearly bankrupt groundfish fishermen.

The main factors of unsustainability identified in the Bangkok Workshop were:

1. Inappropriate incentives
2. High demand for limited resources
3. Poverty and lack of alternatives
4. Complexity and lack of knowledge
5. Lack of governance
6. Interactions of the fishery sector with other sectors, and the environment.

All played a role in the non-achievement of any of the components of sustainability in the North Atlantic, but the main factors are probably the inappropriate incentives, an inadequate governance system, and complexity and lack of knowledge (particularly when combined with an excessive importance given to scientific advice).

The non-achievement of any of the components of sustainability in large volume demersal fisheries in the North Atlantic may be linked to explicitly focussing the fishery management processes on only one of the dimensions of sustainability. The sustainability framework suggested by Charles (2001) implies that all dimensions of sustainability should be pursued simultaneously. In the North Atlantic, the explicit focus has been almost exclusively on the bio-ecological component of sustainability. The other components have no doubt also been pursued, but not as explicitly. The recent reform of the EU Common Fishery Policy, leans towards an even greater focus on the bio-ecological component of sustainability. One of the assumptions underlying such a focus, is that it is necessary to have resources to exploit in order to have fisheries that are sustainable under the other components of sustainability. Another is that fishery management has a more or less direct effect on the resources: an increase in fishing mortality will result in a decrease in biomass, a decrease in fishing mortality will cause the opposite effect, and when biomass increase, recruitment will increase.

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[95] http://www.dfo-mpo.gc.ca/csas/Csas/English/Publications/Stock_Report_e.htm

Unfortunately, links are not so immediate in marine ecosystems. Fish stocks can show temporary increases when fishing mortality is high and keeps increasing, and biomass can decrease when fishing mortality is low. Although it is generally accepted that the probability of strong year classes increases as spawning stock biomass does, at least up to a point, large and even exceptionally large recruitment are known to have been produced at low spawning stock sizes. Indeed, some spectacular stock rebuildings are due to such large recruitment produced by small spawning stock biomass.

Similarly, reductions in fishing mortality can result in spectacular increases in stock sizes in some situations and not in others. Decreases in stock sizes of demersal and subsequently of pelagic species in the North West Atlantic in the late 1960s and early 1970s were blamed on excessive fishing effort. These decreases in stock sizes attributed to excessive fishing effort were very influential in motivating Canada and the USA to extend their jurisdiction on fisheries to 200 nautical miles during the second half of the 1970s. Extension of jurisdiction appeared to be an appropriate response because several stocks increased almost instantaneously off the East coasts of both countries immediately following the establishment of enlarged EEZs.

A closer examination of the data shows that the stock decreases in the late 1960s and early 1970s was at least partially due to strings of poor year classes having been produced at relatively large spawning stock biomasses, and that although the spectacular increases in biomass after extension of jurisdiction were indeed partially the result of a decrease in exploitation (FRCC 1996), biomass would have nonetheless increased even if fishing mortality had not been reduced as drastically: strong year classes, produced by low spawning stock biomasses were already in the water when jurisdiction was extended.

The situation of cod stocks in the North West Atlantic in the 1990s and early 2000s is also informative. In Canada, fisheries on six cod stocks have been closed, or severely restricted since 1992-1993. Only one of them, that found in NAFO Subdivision 3Ps (St. Pierre Bank) has shown some recovery. The other stocks have either continued to decline after the fisheries were closed (the "Northern" cod in NAFO Divs. 2J3K and 3L, and the Eastern Scotian Shelf (NAFO Subdiv. 4Vs and div. 4W), or have stabilised (northern and southern Gulf of St. Lawrence).

It is therefore, not axiomatic that a decrease in fishing mortality will automatically result in increases in biomass. Possible explanations include multispecies interactions and climatic influence on recruitment. These are not normally, or at least not entirely, under human control. The rapid increase in demersal resources at extension of jurisdiction in the North West Atlantic coincided with low biomasses of herring and mackerel, two pelagic species that are known predators of cod eggs and larvae. Similarly, in the North Sea, the gadoid outburst of the 1960s and 1970s was linked to low biomasses of herring and mackerel. Swain and Sinclair (2000) "report a strong negative relationship between the biomass of these pelagic fishes and recruitment rate of southern Gulf cod. This is consistent with the recent suggestion that the success of large predatory fishes may depend on "cultivation" effects in which the adults crop down forage fishes that are predators or competitors of their young." (Page 1321). Incidentally, these authors note that because seals are predators of the three species (cod, herring and mackerel), a targeted reduction of the seal heard may not have the intended effect if it results in an increase in stock size of herring and mackerel. Multispecies effect as those hypothesised by Swain and Sinclair for the Gulf of St. Lawrence are likely to be the norm rather than the exception. Therefore, "simplistic" single-species fishery management is unlikely to have the effect predicted from models that do not explicitly take into account multispecies effects.

Similarly, climate and hydrographic conditions are known to have considerable influence on the dynamics of marine ecosystems. The best examples are found at the extreme of the distributions of species, e.g., it is widely accepted that there were periods "with" cod and periods "without" cod off

Greenland (Buch, Horsted, and Hovgård 1994). Other examples include stock size fluctuations in the absence of exploitation as demonstrated for sardine and anchovies in the Pacific Ocean (Baumgartner, Soutar and Ferreira-Bartrina. 1992. and more recently, Chavez, Ryan, Lluch-Cota and Ñiquen. 2003) and for Pacific salmon (Finney, Gregory-Eaves, Douglas, and Smol 2002).

The combined effect climatic and multispecies influences on the dynamics of marine ecosystems could imply that, although management measures may have some beneficial effect, they are unlikely to achieve the full scale of benefits predicted by models that do not take into account the possibly considerably more important effects of multispecies interactions and climatic influences. This suggest that harvest control rules, constructed mostly without taking into account likely multispecies and climatic effects, are unlikely to yield the intended outcome. This observation is consistent with Saila (1997) who suggests that conventional control theory in spite of its success with well-defined systems such as missile and space station guidance may not be appropriate to control complex systems such as commercial fisheries where the precise structure of the system is virtually unknown and no reliable models of the process to be controlled exist. Success in fishery management may instead require a softer approach capable to handle qualitative information and uncertainty, in a straightforward, transparent and not computationally intensive manner. This description does not correspond to the system in place to manage large volume demersal fisheries in the North Atlantic.

If, indeed, human fishery management actions have much less influence on the overall dynamics of the marine ecosystems than conventionally assumed in fishery models, the large investments in traditional single-species fishery management may not only be fruitless, they may also be counterproductive if they prevent interested parties to act in areas where they could have a higher probability of achieving positive results. Wasted management efforts on factors that could be driven largely by processes outside of the control of the fishery management agency (such as multispecies interactions or climatic influences) would cause a loss of faith in the management system, but more importantly, they may produce irreversible and unnecessary damage to fishing enterprises and to fishing communities (Hilborn et. al. 2001), therefore leading to economic and social unsustainability.

The economic component (at least some aspects of it) of sustainability may similarly be outside the traditional reach of fishery management agencies. Given the substantial involvement of national governments in fishery management in this area over the last 40 years, it must be acknowledged that the current situation is largely the result of government intervention in one way or another (Walters and Maguire 1996). For example, in both Canada and the USA, there was considerable government investment in one form or another to help build domestic capacity in order to replace the foreign fishery displaced when these countries extended jurisdiction over fisheries to 200 mi. This was done in the context of the discussions of UNCLOS where Article 62 request coastal states to make available to other countries the resources that are surplus to the catching capacity of their own fleets.

The discussion above agrees with the review of the analysis of past fishery collapses by the Historical Perspective Subcommittee of the FRCC (1996, page 3) that identified a need for humility in fishery management ("humans cannot control nature in the manner assumed by standard fisheries models") and recognised "that human behaviour is very difficult to control".

5. HOW CAN THE DIFFICULTIES AND OBSTACLES BE OVERCOME?

This review of large volume demersal fisheries in the North Atlantic confirms the conclusion of the Bangkok Workshop that it is not the lack of instruments that is impeding the achievement of the main objectives of fishery management. None of the parties interested in fishery management holds the objective of overexploiting and depleting the resources (Cunningham and Maguire (2002)), or of achieving unsustainability in any of the other dimensions of sustainability, at least for themselves. It is a pernicious effect of many fishery management systems that its end results are often diametrically opposite to the intended objectives of interested parties. The paths to solutions identified by the Bangkok Workshop (allocation of Rights, transparent, participatory, management, support to science, enforcement, planning, benefit distribution, integrated policy, precautionary approach, capacity building and public awareness building, and market incentives) are all relevant to overcoming the difficulties and obstacles.

However, given the history of fishery management in the North Atlantic, as well as the human and financial investments in fishery management in the area, it is unlikely that minor changes to the processes are the solution: a major re-thinking of the approaches seems warranted.

It is somewhat discouraging that after decades of good willed fishery management using the best scientific information available, there is so little to show in terms of positive results on any of the components of sustainability. It should be mentioned, however, that although achievement of sustainability is poor under the four components in the context of the large volume demersal fisheries examined here, other fisheries appear to have managed to achieve bio-ecological and economic sustainability, e.g. the pelagic fisheries in Europe, and the shrimp and snow crab fisheries in Canada. Considering that the social component of sustainability is not achieved, at least in terms of an equitable distribution of the benefits, it will be interesting to monitor whether the other components of sustainability will be affected as a result.

6. MISSING INSTRUMENTS (POSSIBLE GAPS)

No missing instruments were identified for the management of large volume demersal fisheries in the North Atlantic.

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DISCUSSION PAPER 7

THE GULF OF THAILAND TRAWL FISHERIES

by

Ratana Chuenpagdee and Daniel Pauly[96]

Summary

The Gulf of Thailand (GoT) has long been overfished – a well-known fact that shapes many of the fisheries policies developed by the Department of Fisheries (DoF), the Thai government lead agency responsible for fisheries management. Numerous measures have been taken that were intended to reign in the trawl fisheries, the major cause of overfishing in the GoT, to restore and protect the fisheries resource base, to provide food security for coastal and other communities through aquaculture development and to improve livelihood in the fishing communities. The effectiveness of these measures, in their application to the trawl fisheries in the GoT, is reviewed and difficulties and obstacles in the management of these fisheries are presented.

The DoF developed fisheries policies that largely correspond to those that are accepted within the global fishery management community, and which are related to bio-ecological, social, economic and institutional components of sustainability. Moreover, in support of the DoF’s mission, the Thai Government has endorsed numerous international treaties and conventions, notably the United Nations Convention on the Law of the Sea, the United Nations Fish Stocks Agreement and the FAO Code of Conduct for Responsible Fisheries. As a member of the Association of Southeast Asian Nations (ASEAN), Thailand also has endorsed various regional fisheries agreements, besides serving as host for several important fisheries-related meetings, such as the NACA/FAO Conference on Aquaculture in the Third Millennium, February 2000; the ASEAN-SEAFDEC Conference “Fish for the People” in November 2001; and most recently the first Coastal Zone Asia-Pacific Conference in May 2002.

The problems with trawl fisheries in the Gulf of Thailand continue. While the number of trawlers has been reduced to about 8 000 during the past 10 years their cumulative fishing capacity is still well in excess of what is needed for maximum sustainable yield or maximum employment in the industry. Further, their catch per effort continues to decline, while the bulk of the catches now consist of “trash fish.”

The government policies to protect and restore the fisheries resources of the GoT are not effective. Notably, they are not followed by implementing legislation and enforcement (and the corresponding budget allocations). Moreover, they often exacerbated existing conflicts between large-scale and small-scale fishers. Overall, the difficulties of and obstacles for management of the trawl fishery in the GoT are due to inappropriate incentives, absence of policy implementation, poverty in fishing communities, and lack of alternative employments for fishers.

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[96] The views expressed in this paper are solely those of the authors, Ratana Chuenpagdee, Department of Coastal and Ocean Policy, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point Virginia, USA, ratana@vims.edu; and Daniel Pauly, University of British Colombia, Vancouver, British Columbia Canada, d.pauly@fisheries.ubc.ca.

1. INTRODUCTION

This contribution reviews the difficulties and obstacles faced by the Thailand Department of Fisheries (DoF), the lead agency for the management of Thai fisheries, in the implementation of existing fisheries instruments in order to meet fishery management aims. The review is conducted with respect to major factors of unsustainability and overexploitation in trawl fisheries of the Gulf of Thailand (GoT). It also addresses lessons learned from the implementation of various policies, identifies gaps and suggests paths to their solutions. The fisheries in question have been distinguished from a set of six different types of fisheries, by the following description, "these fisheries are really multispecies and multigear. […] These fisheries occur in South East Africa, off West Africa and off Eastern South America. In these fisheries, it may be illusory to consider bio-ecological sustainability at the scale of individual species" (Gréboval, 2002). The mixed trawls emphasized in this review are demersal trawls, such as otter board trawls, pair trawls, and beam trawls, which are the predominant gears in the GoT.

With an area of about 350 000 km^2, the GoT is a typical Large Marine Ecosystem (LME) in term of its size (Sherman and Duda 1999). However, it differs from a number of other LME in being, to a large extent, part of the EEZ of a single country (Fig 1), thus minimizing straddling stocks issues. Moreover, the GoT appears largely unaffected by the massive regime shifts that beset other areas of the Pacific, e.g., the Central/North Pacific (Polovina *et al.* 1995). These features lead to a situation where ecosystem effects of fishing can be evaluated in 'pure' form, as it were, without having to account for the confounding effects of, e.g. foreign fleets operating within the GoT, or environmental fluctuations. This review is therefore focused on Thai trawl fisheries operating in the GoT.

Four main aims of fishery management were identified at the Bangkok Workshop[97] i.e., bio-ecological, social, economic, and institutional. Following the suggested framework from the Bangkok Workshop, we review the trawl fisheries of the GoT in terms of the implementation of the existing fisheries instruments, by addressing three main questions.

Is management of trawl fisheries of the GoT successfully achieving the four main aims?
Why is fishery management successful (or not)?
How can the difficulties and obstacles be overcome?

The review is structured into five sections. First, we describe the key features and development of the GoT fisheries, with an emphasis on the trawl fisheries. Next, we provide a brief overview of the main organizations in Thailand responsible for, or playing critical roles in, fishery management. This is followed by the assessment of difficulties and obstacles to effective implementation, using the suggested framework mentioned above. Examples are given with respect to major factors of unsustainability and overexploitation identified at the Bangkok Workshop, including inappropriate incentives, high demand for limited resources, poverty and lack of alternatives, complexity and lack of knowledge, lack of governance and interactions with other sectors, and with relation to major international instruments, such as the United Nations Convention for the Law of the Sea (UNCLOS), the Code of Conduct for Responsible Fisheries (CCRF), etc. The next section addresses how these factors of unsustainability interact with the achievement of fishery management aims, as well as describes lessons learned from the implementation. The final section suggests some paths to address these difficulties and obstacles.

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[97] Gréboval, 2002. FAO/Japan Government Cooperative Programme International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries, held in Bangkok, Thailand, 4-8 February 2002. Report and Documentation in FAO Fisheries Report No. 672, FIPP/R672.

1.1 Key features and development of the Gulf of Thailand fisheries[98]

The GoT, as defined on Fig. 1, consists of three subsystems: the shallow 'Inner Gulf' (≈10 000 km2); a band of shallow grounds (down to 50 m), bordering the East and West coasts, reaching to the

Cambodian coast on the East, to the border of Peninsular Malaysia on the West (≈ 150 000 km2), and supporting the bulk of the demersal trawl fishery; and a Central Basin (≈ 190 000 km2), with depths ranging from 50 to 80 m, and a shallow sill (about 50 m) that limits water exchanges with the open South China Sea (Piyakarnchana 1989; Eiamsa-Ard and Amornchairojkul 1997).

Primary production prevailing in the GoT is known to be relatively high, with a recent boost by increased nutrients from rivers and shrimp farms, which in turn leads to increasing occurrences of harmful algal blooms, oxygen depletion events ('dead zones'), food poisonings and other pollution effects, particularly in the Inner Gulf (Eiamsa-Ard and Amornchairojkul 1997; Longhurst 1998; Piyakarnchana 1999).

Until the early 1960s, Thai fisheries had been driven mainly by their own, internal dynamics. This was reflected in an emphasis on small pelagics (mainly Indian mackerels, Rastrelliger spp. and anchovies, Stolephorus spp.), caught by artisanal fishers using mainly Chinese purse seine and Thai purse seine, and supplying local markets. Most important among these was the supply of anchovies for making 'fish sauce' (Nam Pla; Ruddle 1986, Pauly 1996).

In the early 1960s, a Thai-German bilateral project introduced and widely demonstrated the use of light 'Engels' trawl for catching demersal fish, i.e., a gear much more suited to the bottom type and demersal resources of the GoT than the gear used in previous, unsuccessful attempt in the area (Tiews 1965, 1972; Butcher 1996). Contrary to the belief that the Thai trawl fishery was a 'North-South' transfer of technology, detailed analysis (Butcher 1996, 1999) reveals that the technological 'package' that was transferred had been perfected in the Philippines, notably in Manila Bay, at the end of the Second World War (Tiews and Caeces-Borja 1959; Silvestre *et al.* 1987). Thus, the developed-country contribution here consisted mainly of facilitating a 'South-South' technology transfer, i.e., overcoming the isolation of developing-country scientists and managers.

The rapid build-up of trawling effort in the GoT was fuelled from two sources:

- extremely high rates of profit by the first trawl operators, quickly reinvested into more trawlers; and perhaps more importantly;
- cheap loans for further fisheries development, mainly from the Manila-based Asian Development Bank, and which markedly reduced the cost of entry into the fishery (Mannan 1997).

A detailed economic analysis of the GoT demersal trawl fishery is given in Panayotou and Jetanavanich (1987), providing details on the various 'market failures' involved. Also this study analyses the exacerbating effect of the global fuel increases of 1973, which jointly with the declaration of EEZ by neighbouring countries, gradually forced the return into the GoT of a large numbers of trawlers that had been operating outside (Butcher 1999).

An important point to stress is the ecological impact of the massive increase in trawling effort that occurred from the early 1960s on, and which resulted, in the early 1980s, in a strong decline in catch per effort, from about 300 kg/hour in 1961 to about 50 kg/hour in the 1980s, and 20-30 kg/hour in the 1990s (Eiamsa-Ard and Amornchairojkul 1997), as well as in a strong form of 'Fishing down marine food webs' (Pauly *et al.* 1998; Christensen 1998; Pauly and Chuenpagdee, in press). Similarly, demersal catches, which had earlier increased in response to the build-up of effort, began to stagnate, and to slowly decrease, while the catch composition changed both within species (toward smaller individuals; Pope 1979; Pauly 1980), and between species (toward small, short-lived species; Pauly 1979, Beddington and May 1982), i.e., toward an ill-named mix of "trash fish." As reported by Chullasorn and Chotiyaputta (1997), 30 to 40 percent of the catch from trawl surveys consists of "trash fish," 30 percent of which comprised of juveniles of economically importance species (Ibrahim, 1999). In addition to the traditional Nam-Pla factories, the simultaneous development of the Thai aquaculture industry provided a ready outlet for the "trash fish" landed by trawlers (Hayase and Meemeskul 1987; Csavas 1993). Sumaila (1999) discusses the now global phenomenon of rapid value increases in small fishes 'subsidizing' the overfishing of larger fishes, a phenomenon which classical economists may view as yet another market failure.

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[98] There is an enormous literature on the history and development of the Gulf of Thailand fisheries and on the interactions with other sectors (partial reviews in Pauly, 1979; Pope, 1979; Hongskul, 1979). This brief account, adapted from Pauly and Chuenpagdee (*in press*), provides key references, serving as a basis for discussion of the issues addressed in this review.

The seminar on the 'Future of Thai Fisheries' (FTF) in October 1987 was an important stepping-stone for the management of Thai fisheries (SEAFDEC, 1987). For the first time, government and private sectors formally discussed fisheries trends in the GoT and suggested some constructive solutions. Interestingly, the FTF seminar participants assigned the deteriorating conditions of fisheries resources in the GoT to the lack of interests from the government sector in promoting effective management and focused research. They urged the government to tighten control in some fisheries, particularly demersal trawls and push nets, in addition to encourage small-scale fisheries and to develop outreach program to increase public awareness about resource conservation (SEAFDEC, 1987)

1.2 Key players in the management of the Gulf of Thailand fisheries

The key player in the management of the GoT fisheries is the Government of Thailand, specifically through its Department of Fisheries (DoF), which is presently undergoing a restructuring process, involving the transfer of some sub-divisions to a newly established ministry, as detailed below.

The DoF plays a major role in the management of marine and freshwater fisheries, notably through its own research centres and fishery stations, distributed along the coasts on the GoT and Andaman Sea, and in major coastal cities. As well, the DoF is responsible for setting and implementing national fisheries policies embedded in the National Economic and Social Development Plan of the Government of Thailand. Until late 2002, the DoF was a unit within the Ministry of Agriculture and Cooperatives; within the new governmental structure, many sub-divisions of the DoF have been transferred to the newly established Ministry of Natural Resources and Environment. Nevertheless, the roles and responsibilities of the DoF remain largely the same, viz:

- enforcement of fisheries laws, pertaining to fishing rights in the Thai EEZ, the fish marketing system, and the conservation and protection of wildlife;
- research on the development of aquaculture, on stock enhancement, feed development, animal health, and fishing gears;
- research and survey of fishing grounds within the Thai EEZ and for distant water fleets;
- designing fishing regulations and operating a system of monitoring, control and surveillance;
- research and development on fish storage and processing, quality control and inspection;
- research and development on transfer of fishing technology, promote aquaculture and other fisheries-related occupations; and
- developing databases and distributing information to interested parties.

Fishery policies are developed for a period of five years corresponding to the National Economic and Social Development Plan. During the Eight Plan, covering the years 1997-2001, policies were intended to resolve the problems of over-exploited status of fisheries resources, degraded habitats, ineffective fishery management in addressing conflicts and high fishing costs. During this period, the production target set by the DoF was 1.73 million metric tonnes per year. As well, the DoF was to promote effective and sustainable management, restore the resource base of the fisheries, and improve living conditions in fishing communities. The DoF attempted to achieve these goals through several measures, such as controlling the number of fishing boats and gears, protecting fish spawning and nursery areas, implementing seasonal closure of the fisheries, promoting allocation of fishing rights to local communities, mitigating the impact of environmental problems, etc.

The fisheries policies developed for the period from 2002 to 2005 largely reiterate these goals, but include, in addition, a focus on the involvement of all stakeholder groups in the management and development of fisheries, in the integration of scientific and traditional knowledge, and in promoting export of fisheries products through quality control and implementation of health and safety regulations.

Although this not discussed here, we must also allude to the role of the Southeast Asian Fisheries Development Center (SEAFDEC), a major regional organization shaping the intellectual context within which the Thai fisheries are managed. Through training, research and information services, SEAFDEC aims at improving the food supply by rational utilization and development of fisheries resources in Southeast Asia. It acts as a catalyst in encouraging regional collaboration through sharing of technical experts and providing forum for discussion between policy makers. Additionally, SEAFDEC provides technical assistance in formulation and implementation of common fisheries policies for the region. Most recently, jointly with ASEAN, SEAFDEC organized a major regional fisheries conference on “Fish for the People” in November 2001, in Bangkok, Thailand.

2. DIFFICULTIES AND OBSTACLES TO EFFECTIVE IMPLEMENTATION

An assessment of the difficulties and obstacles that impede the implementation of fishery management in the GoT is presented below, based on the four components of sustainability, i.e., bio-ecological, social, economic and institutional. Under each component, we assess whether the DoF understands the issues described in Gréboval (2002). Evidence to support our evaluation is provided, using various factors of ‘unsustainability’ as illustrations.

2.1 Bio-ecological component of sustainability

The main bio-ecological aim of fishery management can be divided into three sub-aims, as follows.

2.1.1 To protect, conserve, and restore fishery resources, the environment, the habitat, the ecosystem and bio-diversity

The GoT is part of the Southeast Asia Center of marine biodiversity. For example, as of December 2002, FishBase listed 598 fish species for the GoT Large Marine Ecosystem (see www.fishbase.org). Basic biological parameters (e.g. growth, natural mortality, size at first maturity, etc.) have been published for a small fraction of these species (see e.g., Chomjurai and Bunag, 1970; Hongskul, 1974; Booonwanich and Amornchairojkul, 1982).

As an active member of ASEAN, Thailand has endorsed ASEAN Agreement on the Conservation of Nature and Natural Resources whose parties “agree to preserve genetic diversity by ensuring the conservation and preservation of all species in their jurisdiction especially by protecting endangered species and conserving endemic species”. One of the primary tasks, identified by the government of Thailand, was to bring the laws and regulations into line with relevant international fisheries instruments, such as the Convention relating to the Conservation and Management of Straddling Stocks and Highly Migratory Fish Stocks and the FAO Code of Conduct for Responsible Fisheries (Chullasorn and Chotiyaputta, 1997).

Several measures have been taken for protection and conservation of marine resources in the GoT. Since 1972, trawlers are prohibited from an area within 3 km from the shoreline, and within a perimeter of 400 m of any stationary fishing gear. In 1984, an area of about 26 400 km2 in the GoT was declared as a conservation area, prohibiting fishing by all gear types during spawning season from

15 February to 15 May (Phasuk, 1994). Enforcement of these regulations is far from effective, however, because of socio-economic considerations for small-scale fishers (Phasuk, 1994), whose poverty and lack of alternatives are the cause for this unsustainability.

To provide protection of endangered and threatened species, the DoF issued regulations prohibiting the catching of sea turtles, the collection of their eggs and the export of sea turtle shells. A marine turtle nesting area of about 1.6 km2 in Trat Province, GoT, has been protected (during the breeding season) for the past ten years. Catching of dugongs and collection of corals are also prohibited. The DoF also emphasizes the rehabilitation of fishing grounds, and promotes artificial reef projects to create protected habitats for marine life. The DoF has not, however, established any stringent program to prevent the extirpation of species of long-lived large fishes, such as sharks, rays, groupers, etc., from the GoT.

The Royal Forestry Department (RFD) has also established and managed several marine national parks, and prohibited some fishing activities in certain areas. Predictably, these measures have been contested in the affected fishing communities, whose members often feel marginalized by government policies and regulations. Although RFD attempts to promote community-based management and to provide appropriate incentives to small-scale fishers, particularly through promotion of sustainable tourism in marine national parks (Coastal Development Centre, 2002), it is unable to successfully protect marine resources, due to lack of effective enforcement.

2.1.2 To prevent overfishing

As mentioned above, the GoT trawl fisheries suffer from overcapacity, due to their uncontrolled growth in the late 1960s - early 1970s. This was further aggravated when the Thai Government encouraged the construction of distant water fleet, which in its heyday reached all the way to Oman in the west and Eastern Indonesia in the east. Upon declaration of EEZ by UNCLOS, this fleet had to return to the GoT, adding to the excess effort that was already there (Panayotou and Jetanavanich, 1987).

Another, if indirect, source of overfishing was the build up of coastal aquaculture and poultry industries, which readily absorbed the so-called “trash fish” that the fleet generated (Csavas 1993, Pauly 1996). Similar to the development of trawl fisheries, the DoF had earlier promoted coastal aquaculture, in particular the intensive farming of giant tiger prawn (*Penaeus monodon*) through loans, subsidies and research and development for feed and culture techniques. This was considered an important initiative to support the government policy in increasing fisheries production to meet domestic demand and to increase income from export (Prohmmanon, 1987).

In general, overfishing in the GoT, caused particularly by trawl fishing, is well recognized. The urgent measure agreed upon at the FTF seminar was to increase monitoring, control and surveillance, to ensure conservation of fisheries resources and to protect parental stocks and nursery areas. Additionally, through a Ministerial-level agreement, Thailand has jointly conducted survey of fisheries resources with Vietnam in 1997, and has teamed up with Cambodia to perform joint EEZ patrols to enforce regulations and to promote joint assessment of marine resources (Ibrahim, 1999). All these efforts were meant to help keep fisheries resource base from further deterioration.

Clearly, the two examples above, i.e., the development of distant water fleet and of coastal aquaculture, represent inappropriate incentives by the Thai government, which counteract its attempt to prevent overfishing. The issue with the former has now taken a new form, as the government is currently exploring joint venture programs for distant water fisheries with foreign nations. Most likely, Thai trawlers will continue to fish in other countries’ EEZ, ultimately causing ecological impacts to the host countries similar to those in the GoT. However, joint ventures should bring more benefits to the host countries than bilateral fishing agreements, where the only benefit to the host country is access fee (K. Juntarashote, personal communication).

The issue of coastal aquaculture development, which is still viewed, an important means of food production, supplementing declining catches from captured fisheries, is discussed further below.

2.1.3 *To restore the resources, the habitat and the ecosystems to conditions capable of producing the Maximum Sustainable Yield (MSY), taking into account multispecies and ecosystem considerations*

Although the Thai government acknowledges the need for restoration of fisheries resources and habitats, it has not yet incorporated multispecies and ecosystem considerations into fisheries management. This is not surprising, as the ecosystem-based management concept is fairly new and is difficult to implement, even in developed countries. Thai universities and government researchers have so far lacked the skills and knowledge to apply such approach. This is slowly changing, however, as some DoF researchers have recently received training on the use of a major ecosystem modelling software, Ecopath with Ecosim (EwE), now widely used to address marine ecosystem management issues, and developed by a group of researchers at the University of British Columbia. As a result, a EwE model has been developed for the GoT, which builds on an earlier effort by Christensen (1998; see www.ecopath.org). Ecosystem-based management was also promoted at the first Coastal Zone Asia-Pacific Conference (CZAP), organized by the Coastal Development Centre (CDC) in Bangkok in May 2002, jointly with several partners in the region, North America and Europe, however, (see Conference Proceedings: www.vims.edu/czap).

2.2 Social component of sustainability

Two major social aims of fishery management included in this review are described below.

2.2.1 *To achieve optimum utilization of the resource, ensure safe, healthy and fair working environments and conditions*

Poverty and lack of alternatives lower the opportunity cost of labour, thus allowing seemingly unprofitable fisheries to still earn a positive rent. This is the case in the small-scale fisheries, which compete for resources with large scale trawl fisheries, and whose social and economic conditions have been stagnating at best, if not deteriorating (Nagalaksana, 1987; Pauly, 1987; Juntarashote, 1994). Poverty and lack of alternatives manifest themselves in the large-scale fisheries as well, via the employment of landless farmers from the hinterland and the highlands (Panayotou and Jetanavanich, 1987; Pauly, 1997; National Statistical Office, 2001).

As small-scale fishers saw their catch per effort drop, some of them turned to illegal fishing practices, such as using nearshore push nets, causing damages to seafloor habitats for several organisms and juvenile fish (Nagalaksana, 1987). Although the DoF has given priority to minimize conflicts between small-scale and commercial fishers, conflicts, particularly between push net fishing and other small-scale gears, have accelerated, and in some cases resulted in loss of properties and even lives.

2.2.2 *To consider aquaculture a means to promote diversification of income and diet*

As stated above, the Government of Thailand has strongly supported aquaculture development as a means to increase food production, supplementing production from the sea. Through its Ninth National Economic and Social Development Plan, the Thai government hopes to diversify aquaculture through practices and environmental friendly technologies, as well to improve the quality of fisheries and marine products to meet human health standard. These initiatives are seen as contributing, if indirectly, to a reduction of excessive fishing effort and to help resolve conflicts between trawlers and small-scale fishers.

The Network of Aquaculture Centres in Asia-Pacific (NACA), situated in Bangkok, together with FAO, organized a "Conference on Aquaculture in the Third Millennium" in Bangkok, in February 2000. The resulting 'Bangkok Declaration' acknowledges the importance of aquaculture industry for developing countries, as it contributes to people's livelihood, food security, poverty alleviation, income generation, employment, and trade, as well as complements other food production systems (NACA/FAO, 2000). However, it also stresses the need for successful national institutional arrangements and capacity, responsible policies and goals, and effective regulatory frameworks supporting sustainable aquaculture development. The declaration supports continued development of aquaculture through transparent processes, and co-operation between States, private sector and other stakeholders.

The price of coastal aquaculture development, mostly of giant tiger prawns in the GoT, is particularly high. Rapid expansion of intensive shrimp farming along the coast, some of which involved clear-cutting of mangrove forests, has caused many environmental problems such as poor coastal water quality, deteriorating of marine resources, and saltwater intrusion into nearby agricultural areas. These impacts are poorly understood and, when quantitatively assessed, are usually much lower than the profits that the shrimp farmers have enjoyed. These high profits resulted in the increase in the number of shrimp farms and culture areas from about 6 000 farms in 1987, taking up an area of 45 000 hectares, to 28 000 farms covering 79 000 hectares in 1999 (DOF, 2001). The catastrophic collapses of several shrimp farms in the Upper Gulf of Thailand in 1989 were attributed to poor water quality originated from industrialization within the watersheds and to pollution from the farms (Dierberg and Kiattisimkul, 1996). Many shrimp ponds are abandoned after they become unprofitable, leaving vast areas unsuitable for agriculture or other aquaculture activities.

In sum, continued support for development of coastal aquaculture can bring about both positive and negative impacts, and the latter will predominate in the absence of regulations. Particularly, the interactions of this sector with other economic sectors and coastal environment must be regulated, such as to avoid unsustainable practices. Other types of culture should also be promoted, particularly traditional, less intensive and less polluting systems.

2.3 Economic component of sustainability

The main economic aims of fishery management include two major categories, as follows.

2.3.1 To match fishing capacity to the productive capacity of the resources, the environment and the ecosystem

One major reason for the rapid development of the trawl fisheries in Thailand was subsidies from the Asian Development Bank (ADB; Mannan, 1997), which provided low-cost loans that fuelled an extreme rapid build up of the Thai trawler fleet at a time where profits would have been high enough, in any case, to allow for fleet size increase (Panayotou and Jetanavanich 1987).

Following on its adoption of the FAO Code of Conduct for Responsible Fisheries, the DoF issued licensing regulations aiming to control the number of trawlers and push nets, and thus bringing down the effort extended to catch demersal fishes to optimum, sustainable level. The regulations are considered effective, as the number of registered trawlers gradually decreased from about 10 500 units in 1980 to 7 000 in 1988 (Phasuk 1994). The current number of registered trawlers is reported at 8 000 units (DoF 2002).

In practice, the decrease in the number of trawlers is due mainly to voluntary exit from fisheries by fishers who no longer wish to continue operating. The government policy, while not issuing 'new' license, does allow renewal of license for current license holders, provided that they follow zoning and mesh size regulations (Boonyaratpalin 2002).

The only actual program devoted to matching fishing capacity to the productive capacity of the resources encourages small trawlers to convert themselves as gill-netters, through buy-back program and financial assistance for gear purchase (K. Juntarashote, personal communication). However, as gill nets are allowed to operate within three kilometres from shore, they end up also contributing to excess capacity in the GoT, as well as cause conflicts with other fishers using smaller gill nets.

Considering that not all trawlers operating in the GoT actually have licenses, and, that the current level of effort is still in excess of what will produce maximum sustainable yield, or even maximum employment in the industry (Christensen and Walters 2002), it is inescapable that the Thai government still has a long way to go to match fishing effort to the productive capacity of the resources.

2.3.2 To conduct trade according to the World Trade Organization (WTO) rules, including the elimination of subsidies and to prevent illegally caught fish from reaching their markets

According to the DoF draft fisheries policy for 2002 to 2006, exports of Thai fishery products have steadily increased (at an average of about two percent by volume and nine percent by value per year) from 1997 to 2001, thus providing a basis for continued support of the export industry by the Thai government. This high demand contributes to unsustainability through the increase of catches of extremely valuable invertebrates, especially penaeid shrimp and squids (mainly *Loligo chinensis*), which benefits from the extermination of their piscine predators (Pauly 1984, 1988). The high value of the shrimps and squids thus ‘subsidizes’ and biologically ‘justifies’ continued high fishing pressure on finfishes. The use in aquaculture operations of the small (‘trash’) fishes that result from overfishing, moreover, encourages further fishing pressure in the GoT (James *et al.* 1991). As well, Thailand, having become a major exporter of seafood, is plugged into what is essentially an insatiable global market, in which prices have been rapidly increasing, thus subsidizing what in some cases would otherwise be unprofitable operations.

Technically, only the small-scale fishery sector is subsidized, through low-cost fuel and infrastructure developments. The large-scale sector, however, while not directly subsidized by the government, has access to cheap, tax-free fuel beyond the 12 miles zone (K. Juntarashote, personal communication).

Finally, landings of fishery products are generally not controlled, except when they are for export markets. In such case, WTO rules are strictly followed to ensure that the products can be certified as meeting regulations.

2.4 Institutional component of sustainability

In terms of institutional aims, several components are included in the review, as follows.

2.4.1 To use the best scientific information

DoF regularly conducts fishery surveys and produces annual fisheries statistics. Scientific information from research is used to set management measures such as seasonal and area closures, mesh size limit.

However, the vanishingly small contribution of Thai fisheries scientists to the international peer-reviewed literature (as can be assessed, e.g. via a comparative analysis of the Aquatic Science and Fisheries Abstracts), and the rudimentary stock assessment published by DoF personnel in regional technical reports suggest that the available database on GoT fisheries is underutilized. Or put differently: the GoT fisheries are not managed on the basis of the best available scientific information.

2.4.2 To apply the precautionary approach to conservation and management

As for ecosystem-based management, the concepts and principles of the Precautionary Approach are not well understood and are not considered in the management of Thai fisheries. The fact that large-scale trawler operators organized themselves as a strong ‘Fisheries Association’ may have made it difficult for the government to apply the Precautionary Approach. Indeed, this association has already complained that the current regulations to limit the number of trawlers do not take into consideration the high amount of capital invested in these vessels.

On the other hand, small-scale fishers have participated strongly in conservation and protection of marine and coastal ecosystems. Through support from the government and non-governmental organizations, they have been able to organize themselves, and work together in community projects such as mangrove reforestation, and protection of coral reefs.

2.4.3 To do monitoring, control and surveillance in their areas of jurisdiction but also for those vessels flying their flags on the high seas or of foreign vessels using their ports

Foreign vessels do not generally operate or land their products in the GoT. The only foreign fleets that land their catches in Thai ports are tuna boats from Taiwan, which use the fish markets in Phuket, Andaman Sea, Thailand, i.e. outside of the GoT. Their products are inspected by the DoF officer and certified for quality and regulatory control.

On the other hand, many Thai fishing vessels operate in foreign waters, and not all of them are illegal. A recent report revealed that 1 800 licensed Thai trawlers operate in other States' jurisdiction, while another 2 200 trawlers illegally fish in foreign waters (GMT Corporation Ltd., 2003). One of the strategies commonly used by Thai fishing vessels is to change the flag that they fly depending on whose jurisdiction they enter.

2.4.4 To cooperate with other States to promote conservation and responsible fishing and to resolve disputes peacefully

The Government of Thailand has hosted several meetings relating to the FAO Code of Conduct for Responsible Fishing, which has been translated into Thai and distributed to fishers all over the country.

As stated above, some Thai fishing fleets have long been operated illegally in foreign water and many have been caught. From 1982 to 2001, a total of over 3 000 fishing boats and nearly 30 000 crews have been caught by Vietnam, Burma, India, Indonesia, Bangladesh, Malaysia, Cambodia and Australia (GMT Corporation Ltd., 2003). The ensuing disputes are generally resolved peacefully, at least in those cases where the vessel owners are willing to pay for compensation.

2.4.5 To implement transparent decision-making process and involved interested parties

There is a general acceptance of community-based fishery management system as a participatory approach to ensure effective conservation of resources and sustainable fishery development, and fishery cooperatives and other fishers' organizations are considered one of the options for an establishment of co-management mechanism (FAO/RAP, 1998). One of the priorities among the fishery policies for the period from 2002 to 2006 is to promote participation of fishers in fishery management through establishment of fisher groups and fishery cooperatives and through education and training in production and marketing, as well as in raising environmental awareness.

Public hearings are one of the current forms of public participation encouraged by the DoF, although the participants are often passive. Thai people are not accustomed to open discussion, and thus do not always show up at the public hearing, except when they are directly affected by the discussed issues. Environmental NGOs are useful in this context, as they can help articulate issues, provide support to fishing communities and often encourage them to engage in a dialogue with the government.

2.4.6 To promote the awareness of responsible fisheries through education and training

The DoF has extension services and training departments whose roles are to promote education and understanding about marine resources and responsible fisheries to fishers and public. Training for fishers include transferring of knowledge to improve fishing techniques and marketing capacity, and promoting conservation of fisheries resources through informal and formal education program, information sharing system and local activities to raise awareness of resource importance and environmental values. In addition to the DoF, several academic institutes, including technical school and teachers' colleges, offer degree programs in fisheries management, marine conservation and environmental studies.

2.4.7 To duly take into account the interest of fisheries in planning the multiple use of coastal areas

Although the need to integrate fisheries in the management of coastal areas, where multiple and conflicting uses occur, is widely acknowledged, such planning has yet to materialize (Suraswadi, 1996). This situation might improve, however, with the newly established Ministry of Natural Resources and Environment (MNRE), which now incorporates most of the DoF, and will be in charge of managing fisheries and coastal resources.

Coastal ecosystems of the GoT have been greatly degraded due to factors such as coastal pollution from industrial, tourism and urban development, clear-cutting of mangrove forests for coastal aquaculture and coastal development, ecological impacts of fishing, in particular trawling, on habitats and seafloor, tourism impacts on coral reefs (e.g., through boat anchoring, physical damage by divers) (Chuenpagdee *et al*. 2001, Kuijper, 1999). Lack of integrated planning in the coastal zone is identified as one of the reasons for the multi-faceted problems in the coastal areas. It is anticipated that MNRE will play a major role in addressing these problems.

3. LESSONS LEARNED

We have discussed thus far inappropriate incentives, high demand for limited resources, poverty and lack of alternatives, lack of knowledge, and interactions of the fishery sector with other sectors, and the environment as factors of unsustainability for management of trawl fisheries in the GoT. These factors largely undermine the well-intended government fisheries policies, and impede their success, especially when lacking effective mechanisms for implementation. In most cases, the problems are properly identified and directions to address such problems are broadly described. The difficulties and obstacles yet remain in the determination of what specific actions are to be implemented, how and by whom. Framework for implementation must also include monitoring and evaluation to gauge success and to make necessary adjustment.

Is it realistic to expect that multispecies and multi-stakeholders such as trawl fisheries of the GoT be managed to meet numerous fisheries objectives? The case study of the GoT suggests that, while long-term and global vision for management is needed, an effective strategy might involve setting small, practical objectives that correspond well with the local communities' interests and societal values. The new fisheries policies emphasizing the importance of public participation in fisheries management and the education and training program to encourage stewardship of marine resources will eventually lead to decentralized management system where resources are co-managed by the government and the local communities through transparent and collaborative processes.

Contrary to the widespread opinion, we do not believe that high biodiversity and the ensuring complexity are the major factors that "make it hard to identify proper courses of action" (Gréboval 2002). By the standard prevailing in the late 1970s, when simple surplus production models were routinely applied to the entire catch of trawl fisheries (Brown *et al.* 1976), the declining catch per effort in the excellent series of annual scientific trawl surveys conducted by DoF since the 1960s (Eiamsa-Ard and Amornchairojkul. 1997) had made it abundantly clear that the GoT demersal fisheries were overfished (Pauly 1979, Pope 1979). This inference was confirmed by more detailed analyses, involving simulations based on food web models of the GoT ecosystems (Larkin and Gazey 1982; Christensen 1998). The latter study, using the Ecopath with Ecosim modelling approach, showed that the GoT demersal fisheries had strongly depleted its resources base by the early 1970s. Also, Christensen and Walters (2002) showed that this overfishing impacted catches, rents or even jobs.

In other words, high biodiversity and biological complexity were not objective factors for unsustainability of fisheries in the GoT, though subjectively they may have played that role by suggesting that more knowledge was needed before acting. Already, existing information on the exploited species of the GoT available through databases (www.fishbase.org; www.cephbase.org, etc.) can be used with tools, such as Ecopath with Ecosim, to explore ecosystem responses under different management regimes (Pauly *et al*. 2000, Christensen 1998, Christensen and Walters 2002, Walters *et al*. 1997, 1998).

4. PATHS TO SOLUTIONS

Bio-ecological component of sustainability will require rolling back the excessive effort prevailing in the GoT fisheries. This is a path that at present inconceivable, but which if not implemented will eventually lead to destruction of the resource base of the fisheries, currently hovering at about less than five percent of its original biomass (Eiamsa-Ard and Amornchairojkul 1997). This path could become easier to conceive once the direct and indirect subsidies contributing to pseudo-profitability of the fleets are identified (see Munro and Sumaila, 2002 for a critical list of such subsidies in the case of the North Atlantic).

We suggest that the required reduction of effort should be based on zoning of the marine ecosystem, with the coastal areas consisting of zones opened to small-scale fishing only, plus a number of 'no-take' areas wherein the stocks could rebuild themselves, and only a small band of depth, perhaps between 50-100 m, open to a much reduced trawling fleet. The current three km ban of trawlers and push nets is a good basis for the design of these protected areas, where enforceability will be brought about through participation of local small-scale fishers. Allocation of rights to fishers should not be only to harvest the resources, but also to protect, conserve and restore resources for current and future generations.

The rapid development of the Thai economy (including the tourism sector), only briefly interrupted by the 1999 financial crisis, combined with the decline of population growth rate, should help address the above issue, as well as reduce poverty and lack of alternatives problem, by providing employment options, i.e., by increasing the opportunity cost of labour. A focus on education would also help, as it has been shown to strongly increase mobility out of fisheries under conditions similar to those around the GoT (Bailey, 1982).

The outlook for shrimp farming industry is noteworthy, as the importance of this sector for the Thai economy is strongly emphasized in the new fishery policies. Sustainable management of shrimp farming is feasible through environmental friendly technology and good aquaculture practices. For example, the use of semi-closed system, where minimal exchange of water is required, or complete closed system (no water exchange), for shrimp culture is now considered as a feasible technique that brings about higher yield and less problems with diseases and water quality than the current intensive system (Y. Musig, personal communication).

In addition to promoting the aquaculture industry, other measures to promote economic diversification include improved infrastructure facilities for fish landing, storage, processing and marketing, all of which enhance the quality and competitiveness of marine products in the domestic and export markets (but which also, like all subsidies, contribute to reducing costs, and hence to encourage overfishing). Production of value-added products such as surimi has also been promoted. As a result, fishing communities enjoy higher standard of living and improved social well-being (Phasuk, 1994).

Finally, we believe that an integrated management approach should be employed for the GoT trawl fisheries. While ecosystem effects of trawling in the GoT have already been identified, we lack comprehensive assessment of the social and economic importance of the GoT, which considers total values of fisheries, coastal aquaculture, tourism, and other resources and activities in the GoT.

Research addressing this issue will help formulate appropriate policy measures leading to sustainability of trawl fisheries in the GoT.

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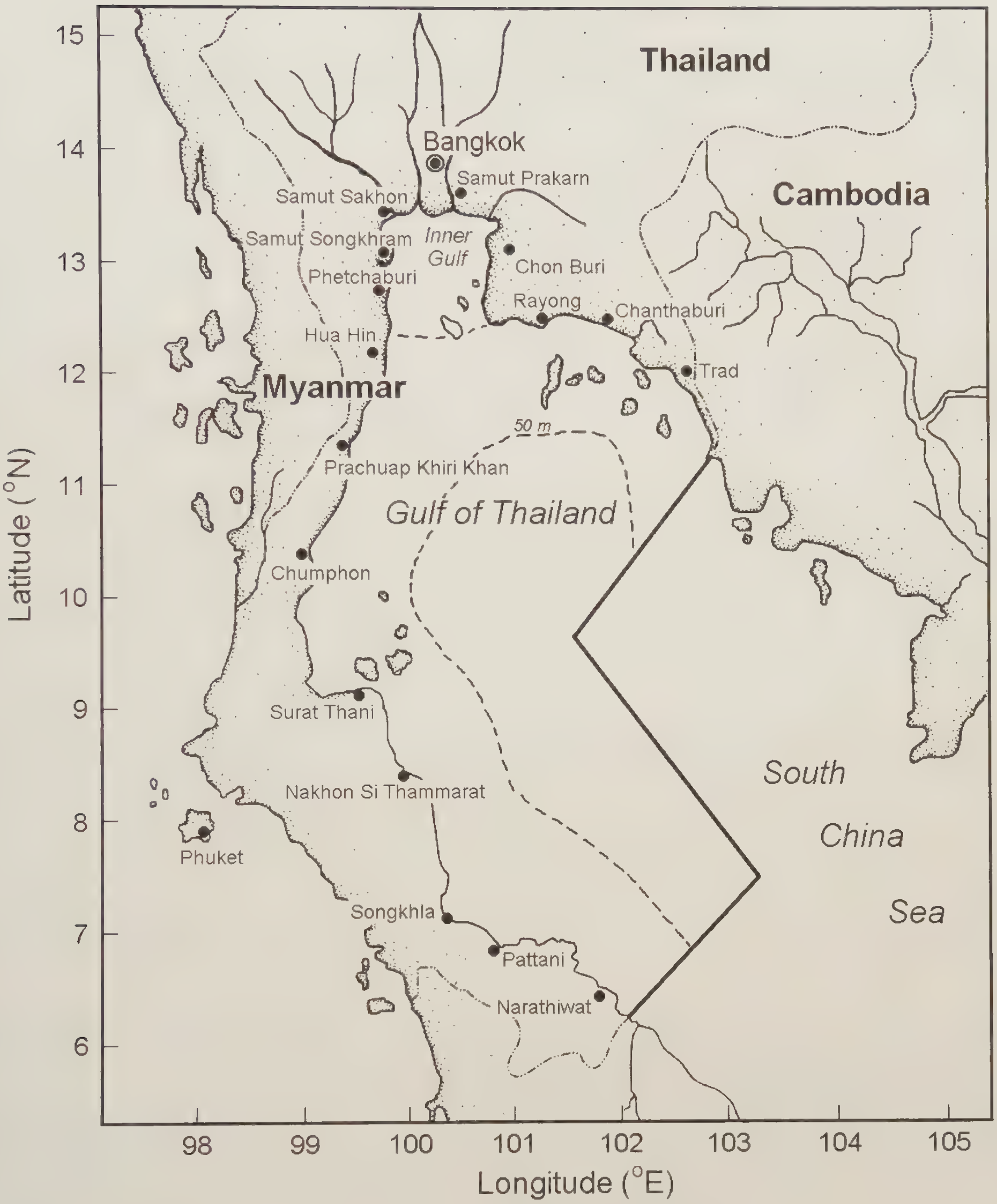
Thailand
Bangkok
Samut Prakarn
Cambodia
Samut Sakhon
Samut Songkhram
Inner Gulf
Chon Buri
Phetchaburi
Rayong
Chanthaburi
Hua Hin
Trad
Myanmar
50 m
Prachuap Khiri Khan
Gulf of Thailand
Chumphon
Surat Thani
Nakhon Si Thammarat
Phuket
South China Sea
Songkhla
Pattani
Narathiwat
15
14
13
12
11
10
9
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7
6
Latitude (°N)
98
99
100
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102
103
104
105
Longitude (°E)

Figure 1. Gulf of Thailand, showing the three sub-systems mentioning in the text (Pauly and Chuenpagdee, in press)

DISCUSSION PAPER 8

THE MANAGEMENT OF MEDITERRANEAN FISHERIES RESOURCES

by

Massimo Spagnolo [99]

Summary

The paper analyses on the basis of Italian coastal fisheries, management procedures and tools, referred to trawlers and polyvalent trawlers, within the four components of sustainability. Difficulties and obstacles in the management of trawler and polyvalent trawler fisheries targeting demersal, crustaceans and molluscs stocks are considered.

The four dimensions of sustainability, bio-ecological, social, economic and institutional, are reviewed as part of the management process and factors affecting the achievement of policy targets are identified. Paths to solutions are addressed with a view to assessing the level of difficulties limiting the achievement of a sound management fishery policy in a context where stocks have been for a long time considered in an acceptable shape.

1. A NATIONAL PERSPECTIVE

This paper intends to contribute to the understanding of the four components of sustainability which have been identified by the Bangkok Workshop: bio-ecological, social, economic and institutional. For each of the four components the main tools and measures adopted by management bodies will be presented in order to assess the achievements of foreseen policy goals.

The main factors of unsustainability will be addressed and some paths to solution will be individuated as indicated by the following table:

Mains factors of unsustainability	**Paths to solutions (with indicative linkage to relevant factors)**
Inappropriate incentives High demand for limited resources Poverty and lack of incentives Complexity and lack of knowledge Lack of governance Interactions of the fishery sector with other sectors and environment	Rights (1) Transparent, participatory, management (1,2,5) Support – science, enforcement, planning (4,5) Benefit distribution (1,3) Integrated policy (1,3) Precautionary approach (4,6) Capacity building and public awareness building (5) Market incentives (1,2)

The analysis will consider a strong multispecies, multigear fishery, as the trawler and polyvalent trawlers fishing demersal species, crustaceans and molluscs in the Mediterranean. It will briefly cover Mediterranean fisheries and the Italian institutional setting. Some peculiar patterns of Mediterranean fisheries will be stressed in an introductory section. The key features of Italian fisheries will further be outlined. Finally, factors of unsustainability and possible solutions will be analysed.

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[99] The views expressed are solely those of the author, Massimo Spagnolo, Istituto Ricerche Economiche per la Pesca e l'Acquacoltura, Italy.

1.1 Mediterranean fishery: the key characteristics

For many centuries Mediterranean fisheries have played an important role in economic, social and cultural terms in the area. Fish production and trade have flourished all over and for millennia this activity contributed to the development of bordering nations. Nevertheless, there is no experience of a high level of overexploitation or overcapacity as occurs in large parts of the world's fisheries. This can be viewed as an unexpected outcome considering that more than one 100 000 vessels are registered for fishing, more than 430 000 fishermen live on capture fisheries and more than 1,5 million tonnes are produced each year in the area with a market value much higher than the average European and international price.

The structure of the fishing industry in Mediterranean fisheries is rather homogeneous and most of the key features of the Italian industry, noted below, are similar to most Mediterranean countries.

- resource fragmentation, strong multispecificity and multigear activity;
- importance of small scale activity carried out all along the coastal area;
- artisanal feature of the productive structure, meaning that familiar income is the
- fishermen target and not profit;
- dimensions of vessels are limited and depend on eco-biological factors and physical structures;
- reduced continental shelf;
- fleets do not move from their home port; only a few segments of the fleet use to fish in waters distant from their home port and only for well defined target species (e.g., shrimps, tuna, sword fish);
- reduced number of shared stocks among different neighbouring countries.

The previous key features, characterising an artisanal fleet with respect to an industrial one, avoided the occurrence of dramatic stock crisis experienced in other fisheries, and allowed, together with management policies, for a substantial sustainability of the Mediterranean fishery resources.

This has been true over time, even if fishing effort has recently increased in the area having a slow, but progressive, impact on some fish stocks. The usual and well known impact on demersal species occurring when overexploitation starts has been experienced in the Mediterranean area, as in many other fishing grounds. Catch composition is changing and species having a lower recruitment age are slowly increasing, while fish size is slowly, but progressively, reducing.

It can therefore, be argued that overfishing in the Mediterranean is not yet a major problem and demersal fish stocks have been for a long time considered in an acceptable shape despite the increasing capacity which has been deployed by different nations participating in the exploitation of the basin. Structural and socio economic reasons allowed for the maintaining of an equilibrium over time, but in recent years showed some deterioration of technical and economic parameters asking public management bodies to pay a greater attention to protect fish stocks.

European as well as national policies have recently become more active and substantial reduction in fishing effort has been reached. Permanent withdrawal, together with other measures have been used, such as temporary withdrawal, protecting fish spawning and nursery areas, moratorium on new fishing licences, moratorium on new capacity to be introduced in the area. New tools now being considered by the management authority. In particular, given that capacity cannot be improved in anyway, limiting days at sea and additional territorial user rights, are discussed for allocation to cooperatives fishing in coastal areas. Introduction of property rights in other segments of the fleet, mainly molluscs dredgers, have been experienced in past years allowing for the full recovery of the resource.

In fact, while conflicts are always possible at local level, the number of interacting fisheries in the area is very low and restricted to a few species, apart from a few shared fish stocks. Each fishery is exploited by fleets of a single country given the limited dimension of the continental shelf; and extra-Mediterranean fleets are extremely rare and limit their interest to bluefin tuna and sword fish only. The previous considerations lead to the conclusion that, apart from specific cases, each fleet works “in isolation” and react to management rules imposed by its own management authority.

The European Union has extended its management role in the area only in 1994, adopting a rule (Rule 1626/94) aiming at the harmonisation of conservation technical measures. Unfortunately, this rule has never been entirely enforced due to some of the factors of unsustainability listed above. Only recently, in September 2000, the European Commission produced a Plan of Action for the Mediterranean fisheries where a comprehensive strategy is outlined for the forthcoming years. Unfortunately, this strategy still relies on a north European stock approach more than on a multispecies effort approach, even if the latter is considered by the EU Commission. The Plan is now under scrutiny by Member States, but it is already clear that, as it is, the strategy does not fit the structure and the culture of Mediterranean management approach. Following the 1982 Convention for the Law of the Sea (article 64), the EU Commission could have instead taken steps to sign agreements with other Mediterranean countries in the field of international cooperation for conservation and management of fish stocks in the area. However, at EU level, the reinforcement of the international cooperation has been limited for the time being to:

- adhesion to important regional organizations such as the FAO/CGPM and ICCAT, planning to financially support regional programmes, particularly for stock assessment (Merits) and statistics (Medicos);
- drawing of a proposal eliminating financial incentives to create joint ventures with third developing countries. Countries benefiting from these incentives have strongly opposed against its approval.

At national level consistent financial support has been given to Mediterranean subregional programmes, such as Adriamed for the Adriatic countries and Medsudmed for the Sicily Channel. Technical support has been secured to Copemed programme which refers to Western Mediterranean countries. The aim of these programmes is to contribute to scientific strengthening of countries adhering to the programmes, establishment of cooperation network and support fisheries management in the Mediterranean.

1.2 Italian fisheries: key features

Italian fishing areas are scattered along the 8 000 km coastline while production is landed in more than 800 landing sites. The fleet is widely distributed and therefore, not concentrated. Only a very few ports show a concentration rate higher than two percent of the national fleet. Flexibility and diversification in fishing gear are typical of the Italian small scale fishing fleet (accounting for more than 80 percent of the fleet). Following the EU strategy aiming at the permanent withdrawal of fishing vessels, in the period 1999 - 2001, the Italian fleet faced an important reduction in number, tonnage and power (-16 percent, -19 percent -15 percent respectively) bringing the fleet at little more than 16 000 boats, 183 000 GT and 1 300 000 Kw, at the end of 2001.

In the period 1996 - 2001, total effort decreased by 15 percent, while global CPUE by 12.2 percent The latter shows a decreasing rate of reduction and in the period 1999 - 2001 it amounted to 3.5 percent while effort reduced by 16.7 percent These figures clearly indicate the existence of a positive path to solution of the conservation of fish resources emerging from the measures undertaken. In case of fleet segments analysed in the paper, it will be shown that the positive impact is much higher.

1.2.1 Legal and Institutional Framework

Act 41, which came into force in 1982, represents the normative reference which, parallel to EU regulations and structural funds programmes, has allowed for sector management through the enforcement of Triennial Plans. The authority responsible for monitoring and enforcing EU and national conservation policies is the General Directorate for Fisheries and Aquaculture, which is part of the Ministry of Agriculture and Forestry Policies. Three Committees have been established, responsible for Fish Industry Management, Research and Financial issues. All the stakeholders involved in the industry are institutionally represented in each Committee, and play an active role in the decision making process.

The management of the sector occurs through a twofold programming level. On the one hand, the national programming activity has the Triennial Plan as its reference operating document. Since 1982, the Triennial Plans have included a detailed analysis of the sector. They are used to define policy objectives and to introduce a variety of measures in different areas of the industry: administration, cooperatives, production at sea, aquaculture, trade and processing, promotion, research. A large set of detailed bio-economic data and information allow for the forecast of future trends of the industry and are used for the drawing of the Plan.

All stakeholders involved in the industry take part in the process and, through their participation in the National Resource Management Committee, approve the final draft, which, afterwards, is signed by the Ministry and enforced.

The Code of Conduct, biodiversity and sustainability approach included in international documents which Italy has subscribed and is committed to observe, have been in place well before their introduction. Several tools have been used for many years and different measures have been introduced in order to achieve these goals. In particular:

- reducing fishing effort in order to allow for economic sustainability of the industry, utilisation of the EU fleet adjustment policy and fleet renewal policy, fleet segments management, temporary withdrawal and protection of fish spawning and nursery areas;
- allocating territorial use rights for fisheries to local communities and fishermen cooperatives following a co-management approach;
- introducing incentives to support a multispecificity approach aimed at integrating fishermen income and stimulate job reconversion;

and many other measures have been applied.

2. ANALYSIS OF UNSUSTAINABILITY FACTORS AND PROPOSED SOLUTION FOR EACH SUSTAINABILITY FACTOR

2.1 Bio-ecological component of sustainability

The main bio-ecological aim is to protect fisheries resources, environment and biodiversity. In this context, measures undertaken by the Italian management authority are set in order to fulfil international commitments and to avoid overfishing, while protecting the resource and fishers' income. In the case of strong multispecificity of the resources, the target is no longer stated in terms of Maximum Sustainable Yield, but concerns the global protection of different stocks.

According to European and Italian legislation, resource management is achieved through the introduction of a mix of different measures aiming at the best possible equilibrium between fishing effort and resources. This target has been pursued through the introduction of an increasing number of measures and tools.

In 1982, a generalised licensing scheme was introduced and all vessels authorised to fish at that time were given a licence. Following the licensing scheme the next step was the introduction of technical measures based on the Italian legislation. The measures were those supported by traditional biological schemes, as minimum mesh size and minimum fish size. The minimum mesh size (40 mm) took some time to be enforced, but compliance was finally secured by fishers. The same result did not apply in case of minimum fish size rule. Of course, given the high level of multispecificity, the latter measure was rather ineffective and hard to enforce, confirming the outcomes of main studies on the issue (OCDE 1997). Compliance, as a consequence, has been low for many years.

At the same time, the role of bio-economic research was strengthened and important financial resources were allocated to research fisheries institutes. Between 10 and 15 percent (five to seven million Euros) of the whole national budget of the fishing industry has been used for research for the last twenty years. At the moment, time series concerning all economic parameters and the main biological parameters are available in Italy. In particular, socio economic parameters are currently used for the drawing of national and European planning documents. Biological parameters have not always been able to be translated into management language and sometimes, due to the multispecificity of resources, they showed to be less effective then economic and technical information for management purposes. In fact, management of strong multispecies stocks can be seen more as an integrated planning exercise, where the type and number of variables increase the complexity of the management model, which will include eco-biological as well as economic, social, technical and other possible disciplines contribution, all of them bringing to the solution of the sustainability target.

Several other measures have been introduced since then. In particular, the following measures were enforced for the specific fleet segments, with the support of fishermen and their association:

- an important decommissioning scheme;
- the fleet was partially renewed, with little increase of capacity, due to the rate of withdrawal linked to the building of a new vessel. In case of trawlers, the building of a new vessel requires the scrapping of an extra 35 percent plus the tonnage which is going to be built;
- modification of technical parameters was strictly limited;
- financial instruments have been introduced to support measures not otherwise covered by other programmes; socio economic measures benefited from these extra funding;
- incentives for multispecificity have been established; activities for the protection of the environment and for the development of sea (fish) tourism started, to alleviate the impact of decommissioning schemes. Aquaculture has been seen as a potential alternative for income integration, job diversification and increased fish food self sufficiency level.

Other measures were considered important and introduced such as seasonal temporary withdrawal for trawlers and pair trawlers together with time limits in the period following the closures, and where there is interruption of any activity in the main spawning and nursery areas. Allocation of territorial use rights to local communities and cooperatives and limits on the use of days at sea, successfully experimented for other segments of the Italian fisheries (molluscs), have been recently discussed.

All these measures have been discussed and have been approved by all fishing industry stakeholders, in particular by fishermen's' associations. It is also of some importance that output measures, individual quotas or any ITQ or multiannual quotas, have never been considered as a tool to enforce in the multispecies multigear Mediterranean fisheries. For different reasons, quotas have been enforced in case of bluefin tuna and clam fisheries. Where quotas have been decided with the participation of fishermen themselves, the resource has completely recovered and significant improvement has been registered in term of income. Where quotas have been decided without the fishermen participation, in particular within a multilevel decision making process (bluefin tuna), a series of problems arose.

In 1994, aiming at the harmonisation of conservation technical measures in the Mediterranean, the EU introduced a rule (Reg. CE 1626/94) where a set of technical measures, most of them similar to those already existing, were established. It emerged that the new fish size limits were lower than those being fished by the allowed mesh size. On the other side, the rule called for substantial moratoria on some coastal traditional fisheries, in particular those having a strong social impact. The above considerations did not allow the enforcement of the rule, which has been subject to continuous derogation since its introduction.

All measures noted above have been taken within plans aiming at protecting, conserving and restoring biological resources within a strategy of bio-ecological sustainability, which is a priority for authorities managing the fisheries in the area. Yet, this goal, which is formally stated as a foreword in every document issued by the authorities, has not always been achieved.

2.1.1 Factors of unsustainability

The factors of unsustainability are at work indeed and management authorities have not always been able to incorporate them in their strategies offsetting the possible negative impact emerging from their action. In particular:

- complexity and lack of knowledge
- high demand for limited resources
- lack of governance,

play an important role in the concrete achievement of the targets, and are addressed below.

2.1.2 Complexity and lack of knowledge

Lack of knowledge is not a major problem in the Italian fishing industry in general and in the trawling segment in particular. The state of the biological resources in the area has been studied for a long time within national and European research programmes. Detailed economic performance of the fleet has been continuously monitored in last twenty years.

Complexity of the process is something to further explore, as it could contribute to unsustainability. Among other things, the following represent perhaps some of the most relevant problems which require further investigation:

- coordination and efficient organization among different research institutes;
- transmission of data and information from research to management through well defined protocols;
- amount of the massive information and its classification in a world of strong biological multispecificity;
- capacity to interpret management authority needs and ability to give proper answer within the decision making process.

Paths to Solution

In the cases noted above, paths to solution can be found in the following measures:

Support – science, enforcement, planning.

Support in science, enforcement and planning encompasses the strengthening of the planning approach in all its dimensions, eco biological, economic, social, technical, and dissemination to different actors of the industry.

Scientific research needs to get out from the academic approach and face the concrete needs of management in order to protect, conserve and restore fishery resources. Auto referentiality, in this case, is a limit to overcome.

Public administration has to play a pro active role in the path to solution. Target identification, measures identification, drawing up the program/plan, enforcement, control and compliance have to be considered as part of a unique planning exercise. Sometime, different administrations are in charge of a single part of the process and interaction is not always granted. Reduced responsibility and passive attitude could be the result.

Fishermen and their associations should play an active role in the process as the other part of the chain. Sometimes they are called only in the final step where decisions need to be enforced. This brings a loss in efficiency for individual measures and tools, and increases difficulties in compliance with the rules.

Capacity building and public awareness building

All cases noted above require the clear definition of a process, institutional procedures and training wherever behaviours have to be modified.

Some of the previous limits emerge due to the lack of reciprocal capability in understanding each others' tools within the management procedure. As an example, part of the scientific information is not properly channelled because of some difficulties in dealing with a large mass of bio-economic information and models. This will also limit governance ability, but in most cases it is matter of reciprocal ability to "read" each others' needs. In general, the more sophisticated the management process, the more demanding the procedure will be in terms of quantity and quality of information. In such situations, the administration in charge of resource management should be commensurately more qualified.

2.1.3 High demand for limited resources.

Demand for fish products in Italy is sustained with respect to internal production. After a long period where internal demand has been steadily increasing, recent years show a constant trend of around 22/kg per capita. Sea food self sufficiency is limited to about 48-50 percent. On the other hand, landings of species caught by trawlers and polyvalent trawlers, following the decommissioning scheme which allowed the reduction of 24 percent of gross tonnage and 13 percent of nominal Kw[100] of the corresponding fleet continuously decreased (Fig.1). In the period 1996/2001 the reduction in landings registered by these segments resulted in more than 50 percent, depending both on reduced capacity and reduced global days at sea (Fig.2). It is worth noting the trend has been downward sloping even if demand pressure increased due to the reduction in landings. The rigidity of structural productive parameters and the management authority stepping up the decommissioning scheme did not allow effort to increase[101].

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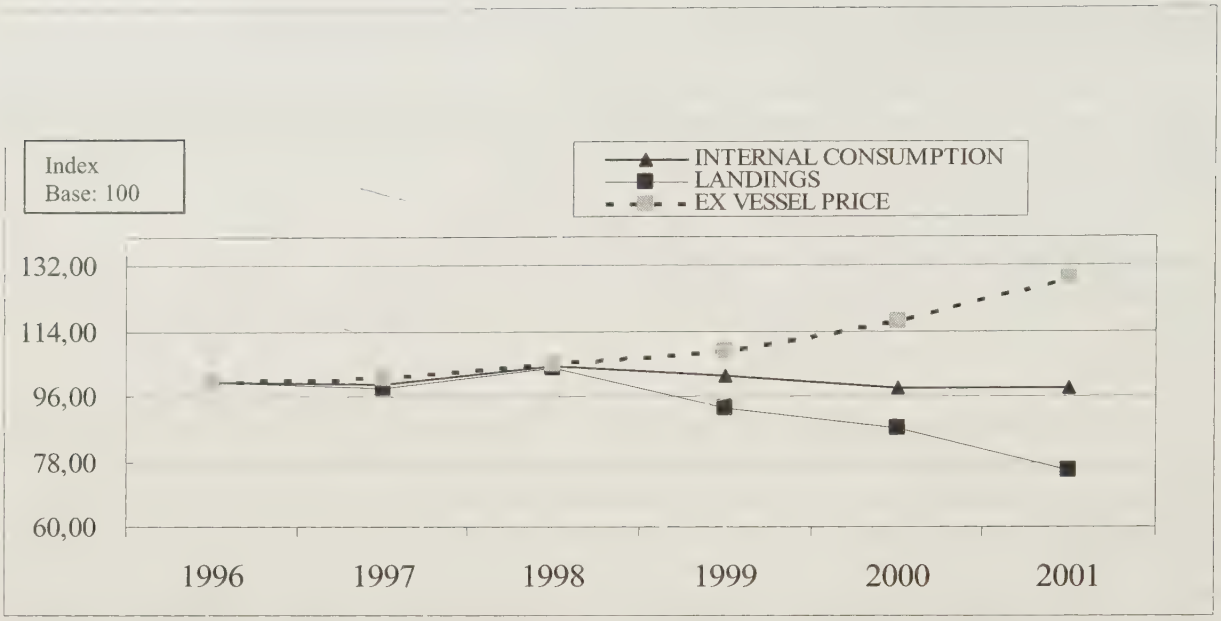
[100] Derating is a widespread procedure. Italy is not an exception

[101] Apart from trawlers and polyvalent trawlers, other gear types have been heavily affected by this programme. The swordfish driftnets have been banned and dredgers are among those segments which have been reduced most. Of course, the social impact has been important. But small scale artisanal fleet and other gears have applied for financial assistance under the EU permanent withdrawal measure.



igure 1. Internal Consumption, landings and ex vessel prices – base 1996 - Italy-

Source: IREPA Observatory

Of course, ex vessel prices grew constantly from €/kg 3.40 in 1996 to €/Kg 4.3 in 2001, more than covering the costs increase, fuel in particular. (Fig.3)

While it is true that the price trend has allowed more fishermen to stay in the fishery, it is also true that those remaining in the fishery slightly increased the number of days at sea, thus increasing individual fishing effort. Yet, global fishing effort was strongly reduced in the segment and outcomes have been satisfactory. The incentive to increase fishing effort [102] due to demand in excess of supply had only a little effect and measures introduced brought the fleet on its path to protect and restore biological resources.

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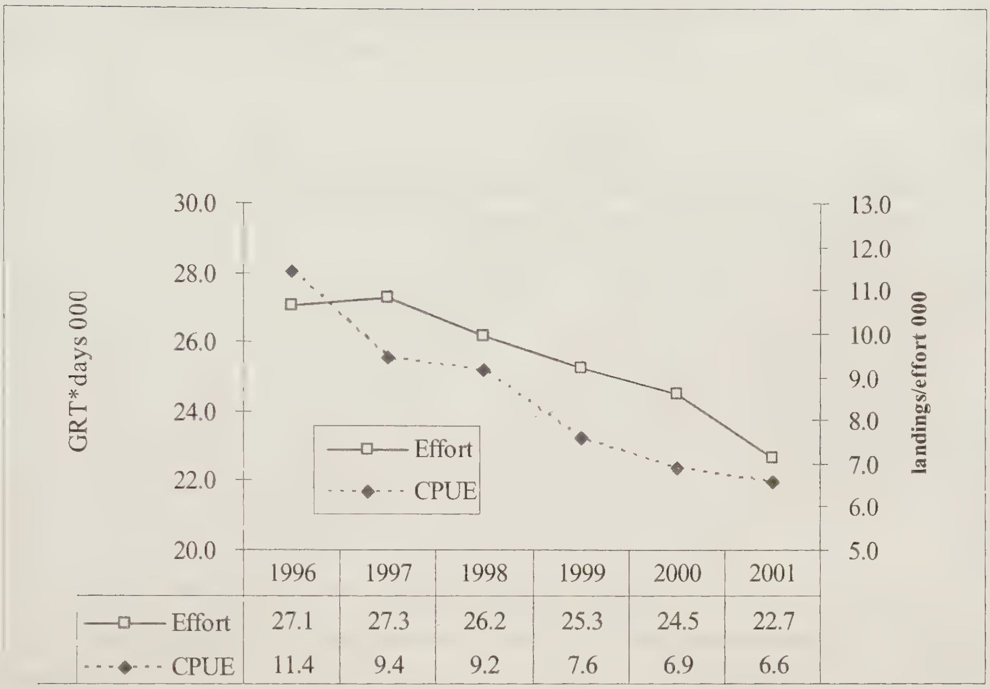
[102] Fishing effort has been calculated according to the EU definition (Reg. CE n. 2091/98).



	1996	1997	1998	1999	2000	2001
Effort	27.1	27.3	26.2	25.3	24.5	22.7
CPUE	11.4	9.4	9.2	7.6	6.9	6.6

Figure 2. Fishing Effort and CPUE – Trawlers and Polyvalent Trawlers

Source: IREPA Observatory

2.1.4 Lack of governance.

The model of governance in Italy is based on tight cooperation among administration, research and industry, all of them institutionally participating in the decision making process and planning. This approach allows for decisions to be undertaken with a strong consensus from each part of the process. Validity and efficiency of the measures to be introduced can be checked against experience in a concerted procedure. It is understandable that vested interests tend to defend their own associates' positions trying to circumvent the procedure and, when considered necessary, establish a direct connection with the political level, thus overcoming the management authority. It will be the responsibility of fishery managers to incorporate, as in a game theory, reactions of stakeholders to policy measures and to apply a fine tuning approach to the greatest possible extent.

But, it is also evidently clear, so far, that the alternative approach, i.e., to exclude the industry from the process while relying on it for enforcement, would bring more difficulties and obstacles when introducing new rules. Experience has shown the importance of the consensus-based approach.

The Regulation (CE) 1626/94 noted above is a clear demonstration of those limits where all paths to the solution of this factor indicated in the Bangkok Workshop are relevant. Lack of participatory involvement and limited support from science brought an unfortunate outcome. The establishment of bluefin tuna quotas has been a failure in many ways. The procedures involved in the setting of quotas, at each different level of decision, do not grant at all as meaningful a role to stakeholders as they should in the full range of management. Those who have to secure compliance with the quota system do not take part in the process. Science has never been able to provide models meeting the support of fishermen. Further, it is a widespread feeling that data and information needed to run models have little reliability. Potentially more restrictive measures to protect fishery resources could have been introduced with the consensus of fishermen, but they are not allowed to participate in the process.

Previous examples show that lack of governance or weakness in governance is experienced every time multi level decisional system is in place in fisheries management, in particular, in case of international procedures. Each level, in fact, will utilise the uncertainties of the system, interpreting the outcomes following its own social and economic interest, and not necessarily assigning priority to protecting, conserving and restoring fishery resources.

In what has been said above, some paths to solutions are apparent. Actions and institutional procedures allowing a more *transparent, participatory, management* of all the stakeholders involved should be stressed together with the need for science to better support the process.

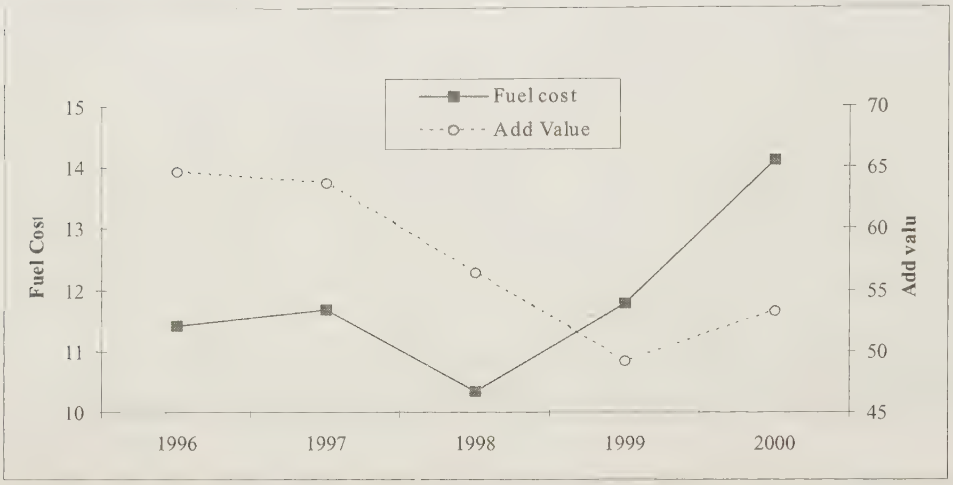


Figure 3. Average fuel cost and added value per vessel, 2 000 Euros

Source: IREPA Observatory

2.2 Social component of sustainability

The social aims of fishery management will consider three different sets of measures as stated below.

Those aiming at a better utilisation of the fisheries resource, ensuring safe, healthy and fair working conditions. All of them can play an important role in the development of a sound strategy aiming at increasing the efficiency of resource utilisation and quality of work on board. In Italy, these measures fall within the EU policy regulations and, at a more or less homogeneous level, have been introduced in the industry. Concerning fish utilisation, in particular, it is true that discards and by-catch are rather limited and unimportant.

Those aiming at alleviating the impact of measures necessary for the modernisation and rationalisation of the fishing industry. Protecting, conserving and restoring fisheries resources, improving the efficiency of the industry, granting a sustainable income to participants, are, all together, part of a planning exercise and are often factors conflicting with the social component of sustainability. In most cases reduction in fishing effort is required and buy back schemes are introduced, other times specific gears are forbidden, or protected marine areas as well as closed fishing grounds introduced. All are examples of measures which have been undertaken by the management authority in Italy. All of them have a negative impact from a social point of view in term of employment, income and livelihood of communities depending on fisheries.

Those aiming at assisting developing countries. Initiatives in this field have been undertaken through regional assistance and scientific cooperation programmes in order to allow an increasing attitude towards responsible fishing in the Mediterranean. Three regional projects are in place, ADRIAMED, MEDSUDMED, COPEMED, and they seem to fulfil expectations. They are operating through FAO/CGPM agreements.

2.2.1. Factors of unsustainability

Inappropriate incentives

The choice of incentives available on the basis of the national and European tools in order to achieve the fishery policy targets has not been always appropriate. In particular, in case of small scale artisanal fisheries, financial incentives to reduce vessel management and capital costs have been widespread and utilised by fishermen, bringing distortions in wealth allocation and rent distribution. In most cases, this allowed a trade off between employment and resource protection through an increase of fishing capacity or, at least, maintaining an effort which would have otherwise been deployed. In case of small scale artisanal fisheries the possibility of building a strategy based on the introduction of *property rights* could contribute to the solution of the problem in a more consistent way, lowering the impact in terms of social unsustainability. Examples are available in different areas and, with excellent results, this has been applied in some cases in Italy as well, but not in the case of trawlers to date.

Complexity and lack of knowledge

In many cases, the wrong choice of incentives depends on the lack of knowledge or lack of capability of the administration in dealing with the complexity of specific reconversion or diversification plans. A Community Initiative, “PESCA” was introduced by the EU a few years ago as an attempt to balance the unemployment generated by the Multi Annual Guidance Programme. In fact, very little benefit has been gained from the large amount of money spent in the programme. Of course, capacity building and public awareness building could have helped the public administration in its effort to limit social shortcomings. Anyway, it is a widespread opinion that this would have not been enough, since an initiative like this requires the participation of beneficiaries and appropriate support in terms of planning, science and enforcement.

Lack of alternatives (more than poverty)

As almost everywhere, fishermen do not have easy access to alternative employment outside the fishing industry. Enforcement of management measures would possibly increase the rate of unemployment in a fishing area and diversification policies have to be considered. The Italian planning policy has introduced for a long time now a multispecificity approach, allowing for income integration and employment diversification. Appropriate incentives and priorities have been considered for specific activities. Aquaculture is one of the possibilities, but activities within the environment protection and control, fish tourism, artisanal activities like shipyards and vessel maintenance, have been supported in case of fishermen reconversion.

It must be admitted that aquaculture has not proved to be a successful alternative as a means for increasing social sustainability. Cases where fishermen, individuals or cooperatives have been able to diversify or reconvert to aquaculture are rare. When activity actually started, it has not always been carried out on a sustainable economic base. Of course, appropriate incentives could include support for tutorship avoiding the experienced shortcomings, but it is the complexity of the activity and its interaction with environment and other productive activities (tourism, industry) and many different public administrations, which makes it the alternative difficult to pursue. In the case of the Mediterranean, it is also true that profits have been very low in recent years and, of course, this is not an incentive to enter fish farming.

2.3 Economic component of sustainability

The main economic aim of fishery resources management, concerning Italian fisheries, is limited to matching fishing capacity to the productive capacity of the resource, the environment and the ecosystem. The other possible aims, such as conducting trade according to WTO rules including the elimination of subsidies and preventing illegal fishing, are of little importance in the national context. Concerning trade, Italy is playing its role on the international market as a strong consumer heavily relying on imports.

Rules and laws for preventing illegal fishing and control by the Port Military Authorities are active. Subsidies are considered of particular importance for social and economic reasons. In terms of IPOA Capacity it is true that subsidies contribute to the worsening of sustainability and the EU which is responsible for these subsidies has tried to cancel out all of them at once at last Ministry Council meeting in December 2002. The EU Commission had to retire its own proposal and transfer the ultimate date for eliminating subsidies for capacity to 2004, when there would be no subsidy left. Why this happened is easily explained. Transparent, participatory management, planning ability, concern about benefit distribution, capacity building and public awareness building were not at all considered.

2.3.1 Factors of unsustainability

Interactions of the fishery sector with other sectors, and the environment

The strategy reported in section 2.1 concerns the attempt of the national management authority to address the capacity of trawlers and polyvalent trawlers with demersal, crustacean and molluscs resources.

The national planning approach has taken as a priority the fulfilment of the principles stated in the UNCLOS and Agenda 21, the IPOA on the capacity of fishing vessels, the Code of Conduct for Responsible Fisheries, Compliance Agreement and, as already illustrated, the whole strategy which has been in place for last twenty years, is committed to this scope.

Capacity reduction has been carried on within the EU framework aimed at regulating fishing effort. MAGP objectives fixed by Community rules have been pursued and a strong reduction in capacity has been reached meeting the targets.

In the period 1996-2001, effort registered a reduction of 16 percent, against a much higher reduction of CPUE, estimated around -42 percent, denoting a deterioration of the exploitation pattern. As it is evident from the figure 2, CPUE shows a continuous downward slope for the whole period. But, as for the period 1999-2001, there is an inversion and the rate of reduction of CPUE is strongly decreasing, showing that measures introduced in the industry proved to be positive and can be considered as a contribution to the solution of the bio ecological component of sustainability due to an efficient management action, involving a high participation from fishermen.

As above reported, capacity reduction has been only one of the many measures which have been operating. It must be stressed that capacity alone could have hardly been able to have a concrete and definitive positive impact on resources. Temporary withdrawal closed spawning and nursery areas, financial assistance for reconversion and income integration and the like played, perhaps, a much more important role in the process of rehabilitating stocks. It is well known that in other EU countries the fulfilment of capacity objectives, even in single species fisheries, did not have any positive impact on resources.

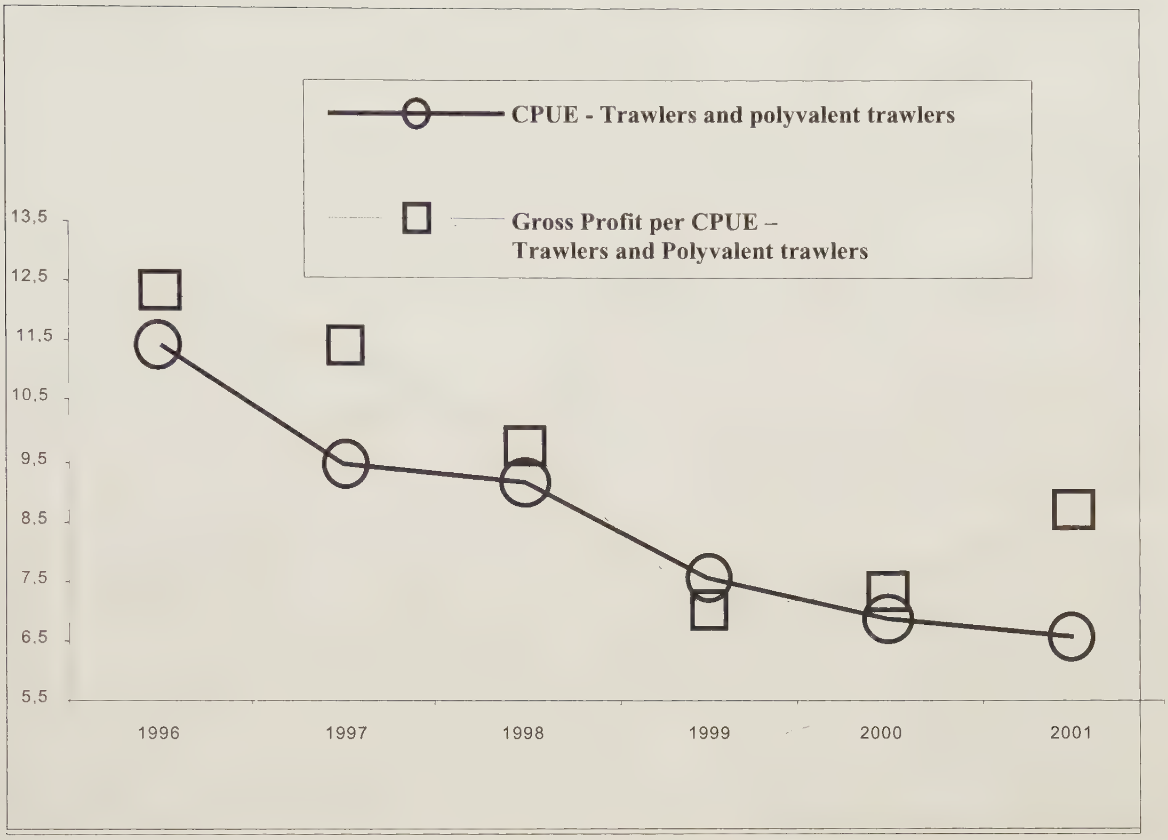


Figure 4. CPUE and Gross Profit per CPUE – Trawlers and Polyvalent Trawlers

Source: IREPA Observatory

CPUE and effort variations over time have been shown above and it is evident that an inversion of the trend has been registered in 1999. It is of some importance to see that also Gross Profits per CPUE, due to the increase in prices more than covering the increase in costs, show an inversion in the tendency and become positive in the same year (Fig. 4). Considering that no expansion of capacity is possible and the scrapping programme will continue in next years, stock as well as economic indicators improvements are foreseen.

Average days at sea have increased and are now at the average traditional level of 180 days per year which is considered as a standard allowing for economic sustainability in the area. In fact, past years have been characterised by many closures not depending on management schemes (war in Balkans, post war closures due to the finding of non exploded air bombs on fishing grounds, algal bloom in the Adriatic), lowering the number of days at sea. Since 1999, the fleet has recovered and reached its standard 180 days of activity at sea. In the same period, fishermen benefited from the good financial results increasing the Capacity Utilisation Rate of their vessels. This has been possible since days at sea for this segment is not yet regulated, but the dimension of the increase is not comparable with the global reduction determined by the reduction in capacity.

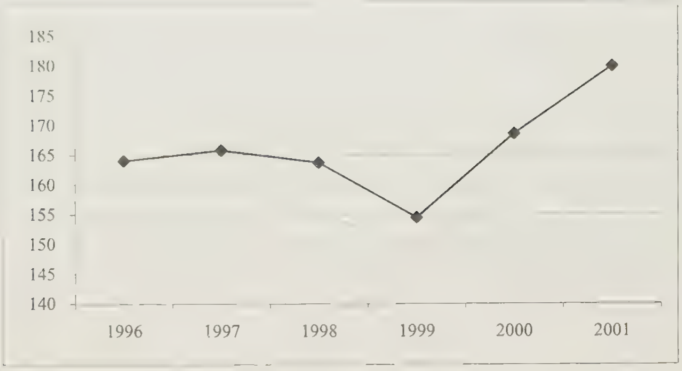


Figure 5. Trawlers and Polyvalent Trawlers Segment – Average Days

Source: IREPA Observatory

Concerning factors of unsustainability it is hard to see any drawback from the introduction of the strategy which has been implemented. Of course, it must be kept in mind that the whole approach is based on two cornerstones. The first is the importance of the mix of measures, while the second, and perhaps more important, is the institutional setting of the fishery management in place.

2.3.2 Paths to solutions

The lesson that can be learned from this experience is that most of the elements considered as path to solution have been active. In particular:

- a transparent, participatory management is in place;
- biology and economics provides the necessary support granting the success of the planning approach;
- distribution of benefits in the whole is accurately considered;
- the planning approach allows for an integrated policy implementation;
- the precautionary approach has always been included in the targets of plans;
- an effort in capacity building and public awareness building is carried out.

2.4 Institutional component of sustainability

From what has been said above, it is the institutional component of sustainability which plays a major role in the framework of a multispecies fishery. Many components bringing to the solution are at work here and only a brief overview is possible.

2.4.1 Paths to solutions

Use of the best scientific and economic information. The General Direction for Fisheries and Aquaculture supports stock assessment surveys and fleet economic monitoring. Annual fisheries statistics are provided regularly for economic information, while scientific biologic information from research is now undergoing a process of diffusing its results. Both economic and biological data and statistical information are regularly used to support the management authority when introducing all kind of measures. In particular, periods of seasonal temporary withdrawal, closed area and technical limitations, drawing of national and specific plans of action, as swordfish, clam and tuna plans are included.

However, the large amount of biological information has not always been used for the production of systematic analysis covering the main stocks of national fisheries. Whenever needed the information is available, but a sort of restricted circulation is so far in place. According to a new statistical EU Programme (Reg. (CE) 1543/00) this limit is going to be overcome, since centralised storage and dissemination of data is now in place.

Use of the precautionary approach This has been in effect for many years. In the absence of a well defined procedure allowing the application of the concept, the precautionary approach has meant the adoption of strategies directed to:

- limit overexploitation by reducing effort (a consistent percentage of the fleet has been reduced);
- restructure the fleet,
- allow for a sustainable income of fishermen by introducing reconversion subsidies and allowing for income integration activities;
- carry on training courses aiming at consciousness rising of the precautionary approach and explaining strategies and measures introduced by the management authority (courses have been usually organised by national fishermen associations and trade unions);
- participate in projects aimed at protecting marine environment, together with environment association.

Basically, the whole industry is faced with the development of the precautionary approach. Of course, efforts have not been able to eradicate misbehaviours of fishermen on a global scale. There are still some wrong attitudes, in particular, in less populated areas, where fishing within the three miles can occur or the 40 mm mesh size is not totally respected. Yet, it is true that the largest part of the fleet is now complying with rules. There is also a feeling that increasing controls at sea have helped in reaching the target.

Implementing a transparent and cooperative decision making process. As for what has been said so far, this issue has been incorporated from 1982 in the Italian fishery management scheme. If a reason for some positive outcomes and the introduction of measures allowing a path to solution of problems has to be identified, this is the specific institutional setting of the Italian participatory and transparent management approach. As for the EU conservation management scheme (what can be called a northern scheme transferred to the Mediterranean) it is quite clear that as it is now, is largely unsatisfactorily. It should be self evident that the passive transposition of the approach from North to South of the Union gives rise to problems and proves difficult to be accepted by those who have built their management culture many years before. Differences in biological stock structures, in economic and social structure, require a specific approach which cannot be taken from outside and enforced in the area. Results have been experienced and rules have not been enforced through a permanent derogation.

Monitoring, control and surveillance. Monitoring is an activity in rapid evolution. Logbooks in the area [103]and the introduction of blue box on board for satellite monitoring[104] are now in place. In recent years, concomitantly with the intensification of management efforts, controls have been improved and results have been reached. (One of the reasons of the success of the permanent withdrawal programme could be based on the intensification of controls.) As for international surveillance, foreign vessels do not fish in areas falling under the national jurisdiction nor do the Italian vessels, normally, fish in other states waters. Yet, it is in the nature of the Mediterranean area to experience, from time to time, conflicts on borderlines. Of course, since the Italian fleet alone represents more than 55 percent of the whole tonnage fishing in the Mediterranean, this is a possible outcome. It is important to recognise that these conflicts are usually solved on a basis of mutual understanding.

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[103] Common Regulations EEC No 2807/83 and 2847/93 modified by Regulation EEC No 2737/99)

[104] Regulation No 686/97 of the Council of April 14 1997.

International cooperation in the area has been a target for many years and it improved in recent years through the adhesion to the General Fishery Commission for the Mediterranean, GFCM and to ICCAT;
the funding of the ADRIAMED, MEDSUDMED programmes, and the participation in COPEMED.

3. CONCLUSION

The above analysis is an example of the role and the weight different factors play in attaining sustainability of fishery resources. In the case of a multispecies, multigear fishery it is clearly evident that some of those factors traditionally considered as vital for resource management do not play the expected role. Reduction in fishing capacity, while is necessary, it is not a sufficient condition for stock recovery. Technical measures are of little use in fisheries like the one investigated in this case study.

If some lessons can be learned from the previous analysis, these would include the following:

- in the functioning of the institutional setting of the fishery management: more than the role of each single item bringing to solution, it is the way single factors are combined and the way managers are able to fine tuning them. Moreover, an integrated approach can contribute to the solution better than measures taken in isolation from all dimensions of the sustainability;
- in the level of the efficiency of the different management levels and in links relating one level to another (multilevel management): each single fishery, either international, regional, shared, transboundary or local, has different management level. It can be shown that a major factor of unsustainability is related to lack of governance (or lack of capacity to secure governance).

As a consequence, in the case of the above analysis, those elements which can better contribute to increase the sustainability of the fishery consist of:

- granting a meaningful role to all stakeholders in the full range of management within a concerted environment process;
- allowing an integrated fishery planning as an exercise involving all dimensions of a fishing industry. While this conclusion can be considered as trivial, it is nevertheless true that very little examples are known, including other Mediterranean countries, to be working like this in practise.

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DISCUSSION PAPER 9

THE MANAGEMENT OF MEDITERRANEAN FISHERIES RESOURCES

COASTAL FISHERIES IN THE MEDITERRANEAN

by

Alain Bonzon[105]

Summary

The paper addresses the management of coastal fisheries in the Mediterranean[106] at regional level with a focus on institutional issues, especially on factors relating to limited governance. The paper underlines the complexity and the lack of standardized data which characterizes the Mediterranean basin as a whole, and needs to be tackled collectively. The institutional features, activities and recent achievements of the General Fisheries Commission for the Mediterranean (GFCM) are reviewed. Enforcement mechanisms for conservation and management measures are emphasised within a system of multi-level governance, characterized by: interaction among at least five levels of governance (global, regional, sub-regional, national and local); the need for an effective decision-making process; and enhanced collaboration and cooperation on policies and activities of the relevant institutions/actors concerned,

1. THE MANAGEMENT OF MEDITERRANEAN FISHERIES RESOURCES AT REGIONAL LEVEL: ISSUES AND OBSTACLES RELATED TO UNSUSTAINABILITY

1.1 Institutional Component of Sustainability

Within a regional perspective, the component of sustainability which is of particular relevance to the Mediterranean basin as a whole is the institutional component,[107] more specifically factors related to limited governance. Without a consolidated framework for good governance at regional level, it seems at first sight premature to tackle the details of other factors relating to unsustainability.

An important factor of unsustainability in the Mediterranean is the lack of common data sets on management parameters for the basin as a whole. This also needs to be dealt with collectively.

1.2 The GFCM System of Governance[108]

Awareness of the characteristics of the fisheries system in the Mediterranean, and of its vulnerability to external factors such as pollution and environmental degradation led to the recognition, more than half a century ago, of the importance to promote regional cooperation in the Mediterranean fisheries sector. In 1949, the General Fisheries Council for the Mediterranean (GFCM), renamed the General Fisheries *Commission* for the Mediterranean during its 22nd session, 13-16 October 1997, Rome, Italy,

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[105] The views expressed are solely those of the author.

[106] Mediterranean fisheries are mostly coastal.

[107] The other components of sustainability, as identified at the *Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries*, 4 to 8 February 2002, Bangkok, Thailand, are the biological, economic and social components.

[108] The working definition of fisheries governance used within FAO is: "A continuing process through which governments, institutions and stakeholders of the fishery sector – administrators, politicians, fishers and those in affiliated sectors – elaborate, adopt and implement appropriate policies, plans and management strategies to ensure resources are utilized in a sustainable and responsible manner. It could be at global, regional, sub-regional, national or local levels. In the process, conflicting or diverse interests may be accommodated and cooperative action may be taken."

Fisheries *Commission* for the Mediterranean during its 22nd session, 13-16 October 1997, Rome, Italy, was established under Article XIV of the FAO Constitution. The Agreement which first set up the GFCM as an advisory body came into force on 20 February 1952 and was subsequently amended in 1963, 1976 and 1997.

The GFCM is empowered to formulate and recommend binding management measures, to which Member States must give effect, unless they object to do so within 120 days from the date of notification (Article V.3).

The GFCM mandate covers the management of coastal, straddling and high seas fisheries of the Mediterranean and Black Sea area. It is also competent for promoting marine and brackish water aquaculture development and for promoting broad fisheries cooperation, including training, notably to cope with North/South and West/East discrepancies, which affect governance. At present, all Mediterranean riparian countries as well as the European Community and Japan are Members of GFCM.

In 1997, the GFCM amended its constitutive Agreement. This was brought on by a number of international instruments which enhanced the role of Regional Fishery Management Organizations (RFMOs) in the period following the 1992 United Nations Conference on Environment and Development ("UNCED").[109] The GFCM launched a series of structural and operational reforms in 1997. Aside changing its name from *Council* to *Commission*, these reforms included:

- introducing explicit reference in the preamble of the GFCM Agreement to recent international instruments, namely: the 1982 UN Convention, 1992 UNCED Agenda 21 and 1995 FAO Code of Conduct for Responsible Fisheries ("the 1995 FAO Code of Conduct");[110]
- endorsing the precautionary approach and decisions based on the best scientific evidence;
- opening membership to States whose vessels engage in fishing in the Region as well as to Regional Economic Integration Organizations;
- establishing an autonomous budget based on financial contributions from Members to complement resources provided by FAO;
- restructuring its internal organization through the establishment of a Scientific Advisory Committee (SAC) supported by sub-committees mandated to deal respectively with the biological, the economic and social, and the environmental dimensions of fisheries management as well as with maintaining the necessary information and statistical base to allow sound monitoring;
- holding annual statutory sessions of the Commission and of its subsidiary bodies dealing with capture fisheries.

The process towards building the foundation for responsible fisheries also required reassessing linkages between some key management issues and governance capabilities, in particular scrutinizing operational objectives, revisiting policy instruments, priorities and time frames and, eventually forecasting associated costs. This meant, *inter alia*:

- with respect to demersal and small-pelagic fisheries: setting multi-management goals encompassing a fair balance between the ecological, social and economic dimensions; and defining a preference for input control approaches, through managing fishing effort and fleet capacity to be complemented by technical measures (closed season, gear restriction, etc.);

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[109] Recent international instruments relating to fisheries conservation and management – the 1995 FAO Code of Conduct for Responsible Fisheries, its International Plans of Action ("IPOAs"), the 1993 FAO Compliance Agreement and the 1995 United Nations Fish Stocks Agreement, for the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, underline the need for all Regional Fisheries Management Organizations to be strengthened appropriately to deal with additional responsabilities. The expectation is that they will play a central role in ensuring that the international fisheries legal order is made effective.

[110] At the time, the 1995 UN Fish Stock Agreement was still under negotiation. It can be argued, however, that it is referred to in the amended GFCM agreement as "other international instruments".

- with respect to large pelagic fisheries: confirming a preference for output control (through acknowledgement of ICCAT quotas and of related measures, e.g., restriction on the use of helicopter, minimum size, etc.).

Governance at regional level primarily entails addressing the institutional component of sustainability as an instrument to cope with the bio-ecological, the social and economic dimensions. In relation to the latter, it can be noted that access conditions have been poorly considered yet for demersal and small pelagic, while the economic and social dimension is seldom considered for tuna. At present, the short/medium term priorities of the Commission mainly include:

- increasing knowledge and accuracy of information on the resource base;
- consolidating management parameters for identified priority shared stocks;
- identifying reference points and indicators for priority fisheries;
- fine tuning the Commission restructuring process.

In this respect, important contributions towards institutional component of sustainability are underway, including:

- promoting the development of multidisciplinary research taking into consideration recently established geographical management units;
- improving and strengthening data collection, handling and dissemination;
- addressing new issues such as fleet capacity, ecosystem approach to fisheries and IUU fishing;
- devising and eventually adopting management measures relating to such issues as effort reduction, minimum sizes, etc;
- strengthening interface between research and the industry;
- acknowledging the sub-regional dimension of fisheries management and multidisciplinary research;
- implementing cooperative projects to enhance capacities in less developed countries.

Another important contribution to sustainable fisheries management is that of regional cooperation and collaboration. With regard to tuna and swordfish, the strategy is to consolidate cooperation with GFCM's sister RFMO, ICCAT. In this respect, a Joint GFCM/ICCAT Working group on Large pelagic species and, more recently, a Joint GFCM/ICCAT Working group on sustainable tuna farming have been established. Also, a practice has developed under which ICCAT Resolutions of relevance to the Mediterranean are reviewed and eventually endorsed by the GFCM, making the latter applicable as recommendations for the GFCM Members which are not Parties to ICCAT.

Technical cooperation with other FAO fisheries bodies is also ensured through the Secretariat. For example, a Joint Working Party for the management of sturgeon is being established between the European Inland Fisheries Advisory Committee (EIFAC) and the GFCM.

Cooperation is also being reinforced with the European Union, the Institutions of Barcelona Convention and other environmental regional organizations, either intergovernmental or non-governmental. The adhesion of the European Community (in addition to four Mediterranean EU Member States) to the Commission will naturally entail some harmonization process either on technical grounds (e.g., statistical standards) or on policy oriented matters (e.g., acknowledgement of the "Community Action Plan for the Conservation and Sustainable Exploitation of the Fisheries Resources in the Mediterranean Sea under the Common Fisheries Policy"). The Community Action Plan, although it applies to EU Member States only and not to the entire GFCM Membership was presented at the Twenty-seventh session in 2002. Harmonization process on policy matters of relevance to the EU is likely to be boosted by the adhesion to the EU of three additional GFCM Members in 2004.

Other contributions to sustainability include cooperative regional projects to enhance capacities in less developed countries and to develop management tools. Projects currently being implemented are: Copemed for the western Mediterranean; Adriamed for the Adriatic Sea; and Medsudmed for the Sicily channel.

It can be noted that, for the time being, the operational focus remains on bio-ecological issues with a view to preventing overfishing and resource overexploitation, while progressively considering the economic and social efficiency of the management system.

1.3 Obstacles and Lessons Learned

The effective implementation of many provisions contained in recent international instruments require that Mediterranean countries through their national fisheries administrations address complex matters, such as the precautionary approach, ecosystem management and measurement of fishing capacity. At regional level, there might even be the need to collectively agree on relevant definitions underlying some of these concepts. Yet, as uncertainties are high, incremental approaches need to be considered to reach common agreements and overcome lowest common denominator decisions of participating Member States.

In terms of governance, the main difficulty remains to mobilize Members' effective will to allow the Commission to actively exercise its mandate and functions, particularly to devise and implement management measures based on the best scientific evidence, and to secure necessary means to operationalize the above mentioned strategy and short/medium-term priorities. There is also a need to better recognize that regional governance might not always match national short term aspirations and goals and that less developed countries face specific financial, human and technical constraints that can inhibit their capacity to meet regional collective requirements and standards.

The obstacles undermining regional fisheries governance in the Mediterranean include:

- weak decision making mechanism;
- limited budget, financial and human resources;
- insufficient scientific knowledge and capacities in a context of inflated requirements for effective decision.

These factors will be examined below together with paths to solutions for improving the GFCM framework and other relevant issues such as: GFCM cooperation with other regional governance levels and other partners; and the establishment or strengthening of enforcement mechanisms for conservation and management measures.

1.3.1 Decision-making process and procedures

As for many RFMOs, decision-making in the GFCM involves or needs to take into consideration many levels of governance, described below.

- *The global level*, comprising the international community and its institutions (e.g., the FAO Committee on Fisheries), which enacts and monitors the norms and procedures agreed upon by States and promote the implementation of international instruments. These instruments, either compulsory (e.g., the 1982 UN Convention) or of a softer nature (e.g., the 1995 FAO Code of Conduct) constitute the framework for fisheries governance for all States Parties to, or which have adhered to, these international instruments.
- *The national level*, the core of the system insofar as States are primary subjects of the international order. This level 'feeds', through a vast array of mechanisms, arrangements and institutions, the other levels of governance.

- *The local level*, which may enjoy devolved responsibility, for example through co-management procedures and/or delegation of powers to specifically tailored institutions such as the Cofradias in Spain, the Prudhomies in France or the cooperatives and consortia in Italy.[111] Responsibility with respect to the local level of governance, however, rests with the national level.
- *The regional level*, in this case the GFCM, which has emerged as a necessity for the continued sustainability of fisheries resources.
- *The sub-regional level*, which allows, for example, the fine-tuning of the management of specific stocks and fleet in support of the work of the GFCM. Examples in GFCM are the projects noted above, Copemed/Western Mediterranean, Adriamed/Adriatic Sea and Medsudmed/Sicily Channel.
- *Other Regional levels*, such as Regional Economic Integration Organizations (REIOs). The difficulty here is that REIOs express a horizontal set of policies and decision-making processes which need to be accommodated within the above described vertical system of governance. At present the most active REIO contributing to fisheries governance in the Mediterranean is the European Community. In the future, other REIOs such as the Arab Maghreb Union (UMA) or the Black Sea Economic Organization (BSEC) might become more involved in fisheries affairs.

The challenge within such a multilevel system of governance remains to identify and integrate the specific needs and requirements of each level of governance, particularly their objectives, behaviour, rules, means and capabilities, as well as ensuring that all levels interact in a cohesive manner through adequate interface. In this context, it is crucial to override conflicts related to law, such as conflicts over legal standards.

The other main constraint at regional level concerns procedures. The tendency within the GFCM to take decisions by consensus led in the past to "lowest common denominator" decisions and eventually to the well known "too little too late" syndrome. The procedure to adopt binding measures (under Article V.3) was seldom used and implementation was uneven. The "user-friendly" objection procedure and the lack of specific mechanisms for dispute settlements in the GFCM Agreement could eventually constitute additional factors undermining the decision-making process.

A possible solution for an optimum decision-making process would be that decisions be timely applied by all Members concerned. Some ways of promoting this might be to agree on a two-tiered system of decision making (e.g., consensus, with a fallback vote), and allow an appeal process in stated circumstances (e.g., if the conservation measure agreed is discriminatory) and a time period rather than an opt-out objection. Even when decisions are advisory, there could be merit in agreeing on an implementation timetable and systematically evaluating actions taken accordingly.

Another important ingredient for improving the effective implementation of decisions would be to involve from time to time high level policy makers in the process as well as stakeholders, in addition to the technicians in the fisheries departments.

1.3.2 Financial and human resources

The financial implications of membership in RFMOs include expenses for attendance at meetings, and for operational costs of the body and its intersessional activities. The 1997 amendments to the GFCM agreement included the establishment of an autonomous budget through contributions by Members. It has been further agreed that Members' contributions to the GFCM operating expenses will be assessed according to a complex but equitable scheme, which incorporates a basic membership fee, contributions based on indexed catches and national wealth. These amendments not being yet in force, the Commission operates currently on a transitional basis, including through extra-budgetary resources provided by some members to support meeting costs and/or for implementing specific sub-regional research projects, namely: Copemed, Adriamed and Medsudmed. The lack of projects to support activities in the Eastern Mediterranean, where most Members are developing States, tends to undermine the work of the Commission in that sub-region.

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[111] The Cofradias in Spain, the Prud'homies in France, and the cooperatives in Italy are professional associations. Their objective is to influence decision-making processes by penetrating political circles with a view to taking part in fisheries management and hence represent their interests. Riparian States, under pressure from these associations, have created negotiating and co-management fora/institutions in the fishery sector to identify common positions between the various pressure groups, take decisions and reach consensus. See Féral, F. 2001, "Sociétés Maritimes, Droits et Institutions des Pêches en Méditerranée Occidentale - revue synthétique des droits collectifs et des systèmes décentralisés de discipline professionnelle". FAO document technique sur les pêches no. 420, Rome, Italy.

An operational autonomous budget might not, however, resolve all difficulties as, among other things, contributions would be effective only for those Members who have ratified the relevant amendments.

A related issue is to ensure in the meetings and intersessional activities of the subsidiaries of the GFCM, full participation of the members of national research institutions, thereby increasing the legitimacy of scientific outputs. This may require in the short/medium term special considerations for training - for example, many countries in the region do not benefit from the services of fisheries social scientists. This also would have implications for establishing and funding work programmes. Realistically, it would be important to maintain multi-source financing schemes for the operations of the Commission, in particular through the institutionalization of the sub-regional projects which ensure much needed assistance to less developed countries.

1.3.3 Provision of timely and accurate data and information by Members

It is acknowledged that the political commitment or the capacity of members to supply timely, accurate and comprehensive data and information is one of the most difficult problems of governance at regional level. It affects management measures in the fields of: conservation; control of catches and effort; fleet capacity; by-catch and discards; and eventually illegal, unregulated and unreported (IUU) fishing and monitoring, control and surveillance (MCS).

In the Mediterranean, data needs are expanding, with the inclusion of ecosystem and social and economic considerations, in addition to those of fishing effort and fisheries governance. In many circumstances, data collection seldom meets even traditional demands. Innovative schemes will need to be found to address additional requirements. An associated issue is the confidentiality of data, e.g., on capacity, for which rules and procedures will need to be elaborated.

Another issue is the adoption of common standards and protocols for the collection, collation and storage of compatible data sets. This is being addressed through the launching of a specific regional project, MEDFISIS, aiming at building an integrated regional statistical system able to respond to the requirements of the Commission but also to the need of individual countries and other regional[112] and global[113] levels of governance. The likely difficulty in the longer term will be, in particular for the less developed countries or for countries with limited fisheries outputs, to bear the burden of rather demanding systems.

Another difficulty is to ensure timely, effective, integrated/multidisciplinary, applied research outputs which fit the immediate needs of the fisheries management decision-making process. This entails a change of attitude to effectively serve the management process, enhanced applied research planning and common understanding of concepts such as precautionary approach and best scientific evidence. At regional level, this implies mounting well-targeted concerted action among national agencies concerned, exercising moral pressure as appropriate, but again without underestimating efforts to be made by less developed States.

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[112] e.g. E.U

[113] e.g. FAO/FIGIS

1.3.4 Regional coordination with other organizations

Regional fisheries management organizations (RFMOs) have entered an era of consolidated outreach and more methodical relation to each other. There is generally cooperation with other organizations which have similar interests on the basis of either geography, species, issues, or simply to avoid duplication.

Reference has been made above to the cooperative arrangements between GFCM and ICCAT. The recent membership of the European Community to the GFCM is likely to engender harmonization talks (with the support of the Members of the Commission which are E.U candidates) regarding various schemes and measures and regarding E.U. policy instruments such as the "Community Action Plan for the conservation and sustainable exploitation of the fisheries resources in the Mediterranean Sea under the Common Fisheries Policy" recently adopted by the E.U.

In a semi-enclosed sea such as the Mediterranean, the very protection of the marine ecosystem at large constitutes a permanent source of concern, notably to avoid massive pollution, effect of land based industry (e.g.,, blooms of mucilaginous algae) or more generally induced human ecological disfunctioning which can rapidly lead to the fisheries collapses as experienced in the Black Sea. This implies special attention to strengthen coordination with environmental international governmental organizations (IGOs, such as the United Nations Environment Program, and the institutions of the Barcelona Convention) as well as with a number of active international non governmental organizations (INGOs). With most of them, GFCM maintains permanent liaison and various cooperative activities.

Within the region, as some organizations are dealing with the same issues tackled from different angles,[114] there is a need for jointly agreed division of tasks at least to avoid overlapping. The challenge is, therefore, to build integrated strategies among regional institutions to address a given issue from different perspectives. This entails giving due consideration to related transaction costs and to allow for necessary time for coordination and planning.

1.3.5 Enforcement mechanisms for conservation and management measures

Some forms of enforcement mechanisms, such as in-zone enforcement, high seas enforcement, flag State enforcement as well as port State control, would be particularly relevant, especially against IUU fishing and for ensuring applicable flag State compliance. It has been acknowledged that in the region, flag State enforcement remains below standards, because monitoring, control and surveillance capabilities in many countries are limited, and cooperative or joint enforcement are in stage of infancy - for example, only four countries are presently developing compatible VMS schemes.

Within the GFCM, the implementation of a decision falls, by default, under the responsibility of individual members. Soft instruments such as moral pressure by the Commission tend to be inadequate for addressing responsible fisheries, or more genuinely to ensure effective action as a result of a decision. For example, following an *ad hoc* meeting of experts on the application of the FAO Compliance Agreement, the Commission adopted, in 1995, two formal Resolutions to pave the way for building a regional register of fishing vessels. Although the Commission has acknowledged, since then, the poor state of implementation of these decisions, progress has been extremely slow, probably because the issue of the confidentiality of data was not addressed. In such circumstances, it can be foreseen that measures such as capacity reduction will be difficult to implement.

With regard to fishing operations, aside from flag State and Port State control, many tools for enforcement could be envisaged. They include, preferably at sub-regional levels and within the framework of specific protocols, exchange of information and blacklisting, prohibitions on transhipments or landings, etc. At regional level, the use of VMS coupled with fishing vessel register seems to be a promising avenue.

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[114] e.g., conservation of sharks

However, establishing enforcement mechanisms at regional level may require as a prerequisite the availability of minimum MCS capabilities at national level and careful assessment of the extend of IUU fishing, prior to enacting strict regulations.

1.3.6 Industry Partnership/stakeholder participation

Communication and improved transparency of decisions has become a frontline issue for many RFMOs in the post-UNCED era. In some Mediterranean countries, governments have begun to forge or to strengthen partnerships arrangements with the industry or are even devolving some aspects of management responsibility to them.

Within the region, some INGOs and other observers to the Commission have, over years, encouraged proactive approaches, carried out valuable research, and raised public awareness on important issues. The GFCM Committee on aquaculture has developed consolidated technical cooperation with industry representatives, among other through carrying out a region wide adaptation of Article 9 of the 1995 FAO CCRF and formulating a related Action Plan for Responsible Aquaculture in the Mediterranean.

In this context, the Commission is assessing ways and means to promote greater participation of relevant stakeholders, particularly from the industry, in its work. With the support of the regional projects, specific fora are organized at sub-regional level with a view to facilitating in the longer run the establishment of regional industry associations or similar bodies.

It is however recognized that, such a process at regional level need to be governed by clear terms, procedures and other relevant factors, at least to secure the legitimacy of industry institutions likely to be involved, including a fair representation and appropriate balance of private interests from all Member Countries.

1.3.7 High demand for limited resource

Overall, factors of unsustainability globally follow at regional level the same patterns as those for coastal fisheries in Italy[115] with, however, important discrepancies from country to country.

For example, the overall *demand* for fish in the region is far superior to estimated supplies for Mediterranean fisheries. This is not evenly distributed: one third of riparian countries reports a positive trade balance while it is estimated that 90 percent (in volume) of import from within the region is attributable to the EU countries. Annual fish consumption varies from less than 2 kg per caput in Syria to over 35 kg in Spain. As in the case of Italy, in most Mediterranean countries fish price increases tend to compensate for any decrease of economic efficiency at vessel unit. Noteworthy, the regular increase of aquaculture finfish production in the Mediterranean (12 percent per year from 1996 to 2002) tends to relax excess pressure on similar demersal wild species, if only by containing price increases.

1.3.8 Path to solutions

Progress toward implementing recent international and regional instruments and thereby strengthening the foundation for sustainable fisheries systems in the Mediterranean are noticeable, although a more proactive stand towards implementing the desired regime still needs to be encouraged. For some analysts, the pace of achievements could appear slow. However, it might be wise to build a robust foundation for sustainability through devoting adequate time to planning at the early stage of the process and therefore ensuring that decisions are based on the best available information.

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[115] Described in Spagnolo, M.; The Management of Mediterranean Fisheries Resources, Discussion paper 8.

The effective implementation also requires strengthening concomitantly individual and collective action at national level. Technical agreement must be reached on complex matters, and incremental approaches would need to be identified: an option could be to adopt provisional measures, as appropriate, as formal solutions are being developed. For example, the GFCM recently favoured a step by step approach to address ecosystem to fisheries management. It established two related working groups – one on anthropogenic effects and fishing technology and another on ecology and environment - with a view to strengthening its Sub-committee on marine environment and ecosystem.

In addition to continuing efforts made in most Mediterranean countries to take into account relevant provisions of the FAO Code of Conduct, ingredients to build the foundation for sustainability at regional level include:

- ensuring adequate financial and human resources to execute GFCM mandates, and ensuring that members are willing to abide by decisions made by the Commission and are consequently prepared to exercise effective flag State control and to provide complete data and information concerning their fishing operations and otherwise required, in a timely manner;
- recognizing that the regional governance needs might not always match national short term aspirations and goals and that less developed countries face specific constraints that can inhibit their capacity to meet their regional obligations fully;
- formalizing coordination between organizations or arrangements with fisheries and environment related competences;
- developing cooperation, in a transparent manner, with private sector interests and non-governmental organizations so as to give broaden stakeholders' participation real effect ;
- strengthening appropriate links between scientific disciplines and expertise on the one hand, and on the other between the scientific community and decisionmakers, policymakers and those responsible for implementing policy;
- promoting the full and equitable participation by members in intersessional activities and in determining and funding work programmes;
- developing harmonized access conditions and, with due consideration to sub-regional socio-economic specifities, control (or limit) overall fishing capacity for priority regulated stocks being harvested in mixed priority, shared-stocks fisheries;
- ensuring effectiveness of scientific or technical committees and their subsidiaries through promoting medium term planning and regular assessment of composition, working procedure and outputs.

1.3.9 Conclusion

Proper management of Mediterranean fisheries relies heavily upon coordinating multi-level governance mechanisms which, if not adequately interpreted, would be propitious to unsustainability. Governance at regional level is a process which should be flexible enough to respond to new problems as well as to new understanding of old ones. It should permanently entail the evaluation of existing and future needs toward building the sustainability of the system. It relies therefore heavily on accurate management planning and evaluation.

The challenge is to integrate the specific needs and requirements of each level of fisheries governance within a coherent medium/long term management planning framework. Such a task calls for renewed expression of political will from concerned countries, transparency of decision making and commitment for implementation, enforcement and adequate financial and human capacities to scientifically support legitimate management decisions.

DISCUSSION PAPER 10

WEST AFRICAN COASTAL AND SMALL-SCALE DEMERSAL FISHERIES

by

Stephen Cunningham, Boubacar Ba and Sidi el Moctar ould Iyaye[116]

Summary

This paper considers the difficulties and obstacles met in particular by States (rather than regional organizations) in implementing existing fisheries instruments, the way that these difficulties might be overcome, the lessons that have been learnt and the gaps which continue to exist. The paper draws on the experience of Mauritania and Senegal. It is important to note that, given the nature of the terms of reference, the paper focuses extensively on problems. This approach is not intended to be critical of the fisheries policy adopted by the two countries but rather to focus on areas where improvement appears possible. In both cases, fisheries policy has evolved substantially in the appropriate direction in recent years and the hope is that this paper may highlight some areas where it is possible to build on the progress achieved so far.

1. BACKGROUND

1.1 Mauritania

Until the late 1970s fishing in Mauritanian waters was undertaken almost exclusively by large foreign fishing vessels, principally large trawlers exploiting cephalopods and demersal species, together with some large pelagic trawlers fishing for small pelagics. During the 1980s, Mauritanian companies and individuals began to take an interest in the fishing industry following the declaration of a 200-mile EEZ in 1978. To begin with, investment was made in units similar to the existing foreign ones. It was only in the 1990s that interest began to develop in small scale fisheries, most of which are thus of relatively recent origin. Even now, a coastal fishery sector (in the sense that this term is generally understood) hardly exists at all.

Although the small-scale and coastal segments are of recent origin, the government has already recognised the need for their management. Decree N° 2002-073, which is the general implementing instrument for the Fisheries Code (Law N° 2000-025), provides a precise definition of both segments. According to this Decree:

- artisanal fishing activity is "undertaken either on foot, or from non-decked vessels, with or without motor, with an overall length no more than 14m, using manual fishing gear, except for purse seines";
- coastal fishing activity involves "non-decked motorised vessels between 14m and 26m overall length, or decked motorised vessels no more than 26m in overall length, with no facility to freeze, trawl or dredge".

The fish resources of most importance to the small-scale and coastal sector are:

- cephalopods, especially octopus;
- high unit-value demersal species (sparids, breams, soles, …);

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[116] The views expressed are solely those of the authors: Stephen Cunningham, Institut du Développement Durable et des Ressources Aquatiques (IDDRA), Montpellier, France cunningham swc@yahoo.com; Boubacar Ba and Sidi el Moctar ould Iyaye.

- high unit-value crustaceans (crawfish, shrimp, ...);
- small coastal pelagics (sardinella, horse mackerel, mackerel...).

The small-scale segment is quite diverse with a number of different types of vessel. Most common (around 60 percent of the total) are wooden dories (pirogues) between 8 and 15 m in length with an outboard motor varying between 15 and 40 HP. About a quarter of the segment comprises plastic (polyester) vessels 8-12 m in length with outboards between 25 and 40 HP. About 10 percent are aluminium dories with similar characteristics in terms of length and motor.

In addition to the outboard fleet, there are around 60 wooden or steel vessels using small inboard motors (around 40 HP).

Finally there are nine steel coastal vessels with larger inboard motors (100 - 200 HP).

In the Banc d'Arguin National Park, there is a traditional fishery comprising some 80 or so small sailed-powered vessels some 6-8 m in length (so-called "lanches").

The recent nature of the small-scale fishery means that participants come from a wide range of origins. Traditional fishers are the Imraguen (relatively few in number - about 6 percent of the total number of small scale fishers) fishing in the north of the country, in and around the Banc d'Arguin area, and the Wolof in the south, in the N'Diado area (around 30 pecent). With the severe drought in the Sahel area in recent decades, numerous Mauritanians have taken up fishing, and these so-called neo-fishers now comprise the largest group (some 33 percent). Finally, a number of foreign artisanal fishers (29 percent) work in Mauritania, largely within the framework of the Mauritania-Senegal fishing agreement.

1.2 Senegal

Senegal on the other hand is a traditional fishing nation with a long history of small-scale and coastal fishing. The coastal demersal resources targeted by the small-scale fishery include crustaceans (shrimp, crayfish), cephalopods (octopus, cuttlefish) and high-valued fish (such as sea breams, soles and thiof). These resources are fished by the small-scale segment using a variety of fishing gears, such as lines, set nets, and traps.

In recent years, overexploitation of these resources has reduced stock sizes leading to a decline in specialisation by gear type. The tendency now is for fishers to reduce risk by becoming more and more versatile, combining the three gear types in one fishing operation.

Two vessel types are used. The first is a wooden dory ("pirogue") of some 16 to 18 m long, using ice to hold the catch on board in insulated boxes. These vessels generally have 40HP outboard motors and six members of crew. The second is a smaller wooden dory of some six to eight metres long, using a 15HP outboard motor.

2. OBJECTIVES OF THE SUSTAINABILITY COMPONENTS

The bio-ecological, social, economic and institutional objectives set for the fisheries sector relate of course to the overall political and economic development of the country. This section briefly discusses this background before turning specifically to the four sets of objectives.

In both countries, the overall goal for the sector is to achieve transparent and sustainable management of natural resources for well-being of current and future populations. This goal is clarified through certain key policy documents.

In the case of Mauritania, the Government's 1998 management and development strategy for the fisheries sector sets out four objectives:

- resource management through enhanced research, improved MCS, development of the small-scale sector and implementation of fishery management plans;
- integration of the sector into the national economy by increasing the value-added created by the sector through higher-valued fishery products, employment promotion, training, and infrastructure development;
- improvement of the institutional, fiscal and financial framework for the sector;
- preservation of the littoral and protection of the marine environment.

In addition to this sectoral vision, national policy trends impact upon the fisheries sector. Among the most important of these are:

- a process of decentralisation, initiated in 1986, which has resulted in the creation of 208 communes, managed under a principle of autonomy;
- the implementation of democracy in 1991 with a pluralist constitution which guarantees fundamental liberties, separates executive, legislative and judicial powers between the executive and instituted universal suffrage for the election of the President of the Republic and representatives at the National Assembly.

Finally, the Strategic Framework in the Fight against Poverty defines the main goals of economic and social policy for the period 2001-2015. This document brings together the various sectoral visions. Its principal themes are:

- sustainable economic growth;
- promotion of pro-poor sectors;
- development of human resources and access to basic infrastructure.

Due to their potential in terms of employment creation and food security, development of the small-scale and coastal fisheries segments is a priority both for the Fight against Poverty and the Fisheries Sectoral Strategy.

The Mauritanian government has adopted a step-by-step approach to the development of its fishery management system that draws on international instruments. Following the development of the 1998 "Strategy for the Management and Development of the Fisheries Sector and the Maritime Economy", the Fisheries Law was updated in 2000 to allow for its implementation. A decree was enacted in 2002 which in turn allows the implementation of the law. The final element in the process is the development and implementation of fishery management plans for the major fisheries. At the moment therefore the Mauritanian experience is instructive on the establishment of a fishery management framework but less so on the implementation of this framework. It is in this area that work is currently ongoing. The Government expects to have an operational fishery management plan for its key resources (especially octopus) in 2003.

A somewhat similar approach has been adopted in the case of Senegal. A Maritime Fisheries Law (No. 98/32) was enacted on 14 April 1998. The implementation of this Law is through a "Sustainable Development Strategy" which was developed in 2001. As with Mauritania, Senegal is now in the position of attempting to develop fishery management plans to implement this strategy.

Both countries have adopted therefore a cascade structure where a broad sectoral strategy and legal structure are first established. This provides an enabling environment within which increasingly focussed legal instruments have been adopted to enable the implementation of Government policy for the sector.

In accordance with the FAO Code of Conduct for Responsible Fisheries (CCRF), both countries have clearly identified the management authority. In each case, a Ministry has the responsibility. In the case of Mauritania, the responsibility lies with the Ministry for Fisheries and the Maritime Economy (MFME). In developing the strategy, law, decree and now management plans referred to above, this Ministry has always paid close attention to the issue of sustainability, so as to meet its legal requirements and conform to voluntary international agreements.

2.1 Bio-ecological objectives

Article 3 of the Mauritanian Fisheries Law (2000-025) says that "the State defines a strategy which seeks to protect its resources and allow their sustainable exploitation in such a way as to maintain ecosystem equilibrium and the aquatic habitat".

In order to attain the bio-ecological goal (together with other objectives), Article 22 of the Law stipulates that fishing activities require the prior authorisation of the Minister for Fisheries and that "no fishing vessel, national or foreign, may fish in Mauritanian waters unless it holds a licence or fishing permit".

Article 31 of the Law expressly forbids the use of explosive or toxic substances for fishing and also makes it illegal to have such substances onboard the vessel.

Article 32 expressly forbids the fishing, capture or retention onboard of all species of marine mammal and turtles, as well as the hunting, capture or retention of all species of seabird. The marketing of these species is also forbidden.

Senegalese fisheries policy incorporates a similar set of bio-ecological goals. The 2001 sustainable development strategy seeks explicitly to:

- reduce the risks of stock collapse, environmental degradation and diminished aquatic biodiversity by promoting responsible fishing and aquaculture practices, protecting coastal resources and environments, protecting critical habitats and reducing pollution;
- restore the fish resource heritage by improving knowledge of overexploited resources and of their environment, implementing rigorous management of threatened stocks, establishing a permanent control system for critical areas and by controlling non-selective gears (shrimp trawls, beach seines).

The 1998 Maritime Fisheries Law includes regulatory measures of an ecological nature including mesh size restrictions, banning of explosives and toxic substances, an extended list of protected marine species, an increased non-trawling area designed to protect coastal ecosystems and measures to protect marine mammals.

Article 26 of this Law gives the Minister the right to suspend or revoke fishing licences for reasons relating to fishery management plans or simply because of an unanticipated development in the state of the fish stocks.

2.2 Social objectives

Article 3 of the Mauritanian Fisheries Law states that "the biological resources constitute a national heritage which the State is required to manage in the national interest". Other than this, social objectives are given little explicit recognition.

In an attempt to limit post-harvest losses, which do have a social dimension, Article 21 of the Law stipulates that a Decree should be enacted that would restrict discarding at sea.

Issues relating to the working environment (health and safety, equity) are in principle covered by the National Labour Law, which covers all types of labour. However, systems of social security and insurance have yet to be put into place for the small-scale and coastal fisheries segments. Fishing safety together with anti-pollution measures are covered by Law 1995-09 which concerns the Merchant Navy, Law 2002-04 which relates to the organization of search and rescue activities at sea, and a Statutory Instrument (n° 33) which concerns the minimum safety requirements for ships and artisanal vessels. A draft law has been prepared concerning the maritime environment.

The issue of promoting mariculture is not relevant at the moment given its low priority in Mauritania. However, efforts are underway to develop aquaculture at inland sites.

The Senegalese sustainable development strategy includes a component to "enhance the value of fish production". Among target activities are: to reduce post-harvest losses at sea by using more selective fishing gear, to improve handling and quality onboard vessels, to reduce post-harvest losses of landed fish, to improve the transport system from landing to market.

The issues covered by the working environment are partially covered. To increase safety is a primary objective of the authorities. It is a legal requirement for instance to wear lifejackets and to use safety equipment and lights onboard the pirogues. Failure to observe these safety rules is a punishable offence. Despite these efforts, in practice the non-observance of the rules continues to be the norm.

Health and equity tend not to be priority issues. The environment within which the fishers operate tends to be one characterised by a lack of social protection, illiteracy, and a lack of collective infrastructure. Such an environment has negative repercussions on the health of the populations.

The current management system does not address questions of equity. There is no control over how much of the resource is taken by different actors, and as a result users of different gear types blame one another for overfishing.

A lot remains to be done in the social area. Priority issues including underage working, lack of schooling, and lack of social protection.

It seems clear in the case of both countries that social objectives have been incorporated into fisheries policy to a much lesser extent than bio-ecological ones. This is somewhat ironic given that the ultimate aim of fisheries exploitation and management is presumably to achieve social and economic goals, subject to the bio-ecological constraints imposed by the resource and by nature in general.

2.3 Economic objectives

The need to bring fishing capacity into line with the fishing possibilities offered by the resource is widely recognised. This issue features in the 1998 Mauritanian Strategy document. In line with the CCRF, the 2002 Decree specifies the broad content of the management plans which must be developed and implemented for the major fisheries. Among the requirements for a management plan are to:

- determine the TAC or the corresponding effort;
- define fishing authorisations for both national and foreign fishers;
- provide guidance on the optimal structure of the national and foreign fleets.

The issue of eliminating subsidies does not arise. In fact, given the importance of the fishing sector for the Mauritanian economy, the small-scale and coastal sectors are required to contribute to the general exchequer through the payment of an access fee. Although positive, such payments are currently small and a significant issue for the Government is how to combine its objective of extracting rent from the resource with its objective of developing the small-scale and coastal segments.

The Decree addresses to some extent the issue of IUU. In the case of under-sized species it is forbidden not only to catch and retain them but also to sell, buy, transport or use them in any manner. A similar restriction applies to berried crayfish.

The Senegalese Fisheries Law 98/32 instituted a system of annual or multi-annual fishery management plans. This idea was taken forward by the sustainable development strategy which proposes a fishery management system including the management of fishing capacity.

Subsidies continue to be granted in an attempt to encourage the development of desirable economic activities. There is no reason to believe that Government policy is about to change on this issue.

The legal framework to prevent illegal fishing is well established (ban of transhipment of catch not authorised by the Law, size and weight restrictions) but its application is ineffective. Problem areas include the export and/or local marketing of immature fish and the catching of unauthorised species (e.g. marine turtles).

The implementation of fishery management plans is held up by the fact that the nature of fishing rights giving access to the resource remains to be defined. Regulatory measures concerning fishing capacity have yet to be taken.

2.4 Institutional objectives

The institutional objectives which flow from the various international instruments have been broadly incorporated into Mauritanian fisheries policy.

The need to use the best available scientific information taking into account socio-economic studies and traditional knowledge is adopted more or less verbatim into Article 2 of the Decree. This Article stipulates that management plans must be developed on the basis of scientific advice together with socio-economic studies and in collaboration with professional organizations and the National Consultative Council for Fisheries Management and Development.

Data are widely collected on the sector and its performance. If anything, there is too much information from different sources (research, Ministry, monitoring and control, SMCP, customs, central bank and others). Although this information is widely disseminated, there is a need for a fisheries information system that can reconcile different data sources.

The precautionary approach has been integrated into the new Law. Article 28 states that the Ministry may refuse to grant or renew a fishing licence if the precautionary principle so dictates, and Article 6 sets out, in general terms, the precautionary measures that the Government should take in the event of unforeseen developments in the case of a fishery or in the case of fish resources in general.

A system of monitoring, control and surveillance exists. The heart of this system is the DSPCM, but this Direction is supported by numerous other institutions, including various Departments of the Ministry, the Research Institute (IMROP), and the fish marketing organization (SMCP).

The requirement for a transparent and participative decision-making process is also included in the Law. Article 12 establishes a Consultative Council for Fisheries Management and Development. The attributions, operations and composition of this Council are to be established by the Council of Ministers on the basis of a proposal made by the Fisheries Minister.

The need to collaborate with other countries so as to promote responsible fishing has also been recognised legally. Article 11 of the Law foresees the establishment of a consultative framework at the regional and sub-regional levels when fishery management plans are being developed concerning shared stocks. The goal is to harmonise national fishing plans.

The need to promote responsible fishing through education and training is one area where much remains to be done. Mauritania could usefully be supported in this area.

Finally, the need to take account of fishing interests when undertaking coastal area planning is recognised. A draft Law has been prepared on this topic and Article 11 stipulates that the utilisation of the Public Maritime Domain must take into account the current use of maritime and terrestrial natural units, as well as the need to preserve sites, habitat, landscape and biological resources.

Similarly, the eight components of this objective are clearly covered in the Senegalese Law and in the sustainable development strategy.

The issue of participation features in Law 98/32 which proposes the creation of consultative bodies at both national and local levels involving representatives of the administration and socio-professional groups. The idea of these mechanisms is to ensure effective industry participation in the development of fishery management strategies and plans at all levels.

In order to enhance transparency, fishers are represented on the Consultative Commission for Licence Attribution.

In order to improve MCS, the Law requires vessel captains and those responsible for small-scale vessels to provide catch information. Other requirements relate to vessel marking and observer programmes.

Finally, the Law seeks co-operation with third countries on matters concerning fishery management and allows regulatory measures to be taken in all relevant areas.

3. OVERALL ASSESSMENT

Until recently fisheries policy priorities tended not to be very clearly established. Sectoral policy documents tended to include a variety of objectives with no indication of relative importance. This absence of priority has often led to incoherence and even contradictions in fisheries policy. In Senegal for instance a fishing effort freeze was imposed for overexploited coastal species at the same time as incentives towards overfishing continued to be given (tax breaks, development of onshore capacity etc). A recent FAO TCP has clearly exposed the inadequacy of sectoral planning in Senegal, emphasising that the priority is to establish a fishery management system based on clear rules concerning access to the resource. This new vision of key objectives for the sector has since been adopted by the authorities.

In this context, international fishery instruments have had a positive impact since they have required States to focus on a range of key objectives (from social through to bio-ecological). The downside however is that the requirements made of managers have become numerous and setting priorities becomes crucial. The more exhaustive the requirements become, the more difficult it becomes to satisfy them in practice, if only because of the problem of funding them all.

The main requirement seems to be for more attention to be paid to social factors, possibly at the expense of bio-ecological ones. Institutional objectives seem generally to have been included. Another issue is how to integrate these objectives.

Despite the progress made, however, neither declarations of intention nor a legal arsenal are sufficient to guarantee an effective system. The next section turns to the issue of the extent to which the objectives set out above have been achieved in practice.

4. WHY IS FISHERY MANAGEMENT SUCCESSFUL (OR NOT) IN ACHIEVING OBJECTIVES

The previous sections show that, in developing fisheries policy, great attention has been paid to incorporating the objectives into policy documents. This section attempts to assess how the factors of non-sustainability have been taken into account, the extent to which objectives have been achieved and where they have not, the reasons why not. It is important to stress that it is still early days for the management system. The process of developing fishery management plans has only just begun. It is interesting to consider that in leading "fish policy" countries such as New Zealand and Iceland the current management systems have developed over more than twenty years (and that they continue to develop). Arguably, one issue that needs to be addressed is the time required to implement change. In many cases, it appears that insufficient time is given to implement one set of institutional arrangements before another set appears, or is at least recommended.

This issue of time is relevant to the examples that it is possible to use. Although the broad objectives of Mauritanian policy and the strategy documents relate to the small-scale and coastal fishery segments in their entirety, so far progress has only really been made in the case of the cephalopod fishery, and even here it is very early. Examples will be drawn largely from this fishery therefore, and especially from the octopus which is the most important of the cephalopods in Mauritania.

4.1 Bio-ecological objective

Although this objective appears to be broadly achieved in Mauritania, its continued achievement is threatened by a number of the factors of non-sustainability identified by previous working groups. The most important of these are:

- inadequacies in the governance system: conflicting objectives, lack of authority and absence of appropriate institutions;
- inappropriate incentives, particularly economic, that tend to promote unsustainable practices rather than sustainable ones;
- interactions of the fishery sector with other sectors, especially offshore petroleum exploration.

To the extent that the objective has been achieved, and in an attempt to deal with the current deficiencies, the Government has adopted the following solutions.

The need to protect octopus has been recognised by the public authorities and the necessary capacity has been created to provide such protection. In particular an institutional framework is gradually being developed involving the "Administration" (Ministry, MCS, Research), legal aspects (the Law and its implementing instruments) and a socio-professional organization (National Fisheries Federation). And the political will to manage the resource sustainably has been expressed via national and sectoral policy documents.

The need to support science, planning and MCS has also been explicitly recognised. A national research institute (IMROP) has existed for many years but over the past five years or so, a substantial investment has been made (and continues to be made) in human and other resources. This research institute is charged with providing the "best available scientific information" upon which management plans can be built. At the same time, the Ministry has established a Department (DEARH) whose mission is to develop and monitor management plans, working closely both with research and the profession. Finally, MCS is the responsibility of a Ministry Department (DSPCM) which is increasingly well equipped.

Great stress is laid upon the need for transparency and participation. The major policy and legal documents (Strategy, Law, Decree) that serve as the basis upon which the sector is managed have all been developed in close collaboration with the profession and especially with the Federation. In the case of the management plan being developed for the cephalopod fishery, very wide-ranging consultation and collaboration has taken place, culminating in the creation of a Support and Consultative Committee, with members widely drawn from the Administration, Research and the Profession and charged with developing the plan. This current framework is due to be complemented by the creation of the National Consultative Council, which itself may establish special commissions (with a broad membership, including the Profession) to examine questions relating to particular fisheries.

This process has enabled a certain number of measures relating to access and technical matters to be instituted which have contributed to achieving the bio-ecological goal. Measures to regulate access include:

- all fishing vessels must be licensed;
- the new Decree (2002) creates a specific category of small-scale cephalopod licence with associated gear (pots, traps, or jigs), and a similar licence for the coastal segment;
- licences require that an access fee be paid - fees are low, but at least subsidies are avoided and, more importantly, the principle of payment for the right to fish is clearly established;
- fishing effort is frozen at its current level - the Ministry refuses to grant any new licences, especially for cephalopods, for the trawler segment.

Technical management measures include:

- minimum size limits;
- mesh size restrictions;
- fishing zones;
- closed seasons - this measure is particularly easy to control, and it is argued has played a major role in protecting both spawners and juvenile octopus and has therefore contributed significantly to achieving the bio-ecological goal;
- by-catch restrictions;
- marine protected areas: Mauritania has a number of national marine parks (the largest, the Banc d'Arguin, represents 2.5 percent of the EEZ). These parks are more or less closed to fishing (apart from some traditional subsistence activities). They are considered in terms of fish resource capital, and appear to have helped meet bio-ecological goals.

In Senegal on the other hand the assessment is that the bio-ecological objective remains to be met. The principal problem is that the factors leading to overcapacity and overfishing continue to be important so long as a policy determining access to the resource has not been put in place. The race for fish continues. The main policy gap is a system for the allocation of fishing use rights. The needs to overcome this difficulty include technical assistance (expertise) in fishery management, training in fishery management, appropriate levels of human resources in the fisheries administration, financial resources to accompany the required disinvestment in fishing capacity and the strengthening of MCS capabilities.

4.2 Social objective

Significant progress may have been made in achieving the bio-ecological objective in Mauritania, but the same can hardly be said of the social objective. Almost everything remains to be done.

The Government is acutely aware of the social objective, and attaches particular importance to the need to ensure that the nutritional potential of the available fish resources is utilised in an optimal manner. However, a number of difficulties stand in the way of achieving this goal.

First, Mauritanian fisheries are currently multi-specific. Although some fisheries are highly selective, the best example being pots in the small-scale cephalopod fishery, on the whole fishers find it difficult to be selective in most fisheries with the gears and gear types currently in use. As a result, discarding is a significant issue, especially of low-valued species where the fishers are targeting a high unit-value species. Other species may be exploited only for a part of their body, shark fins or mullet roes for example.

The issue of fish consumption is not simply a supply-side problem however. There is no long tradition of fish consumption in Mauritania, meaning that many of the fish resources which are well considered in other countries find no market in Mauritania. This problem of "tastes" is made worse by the general lack of purchasing power of Mauritanian consumers, especially when compared with rich country markets such as Japan and Europe. As a result, a very high percentage of Mauritania's fish production is exported, and producers concentrate on those species of interest to export markets.

Another aspect of the social agenda concerns working conditions. On the whole, the work environment in the fishing industry is such that it guarantees neither the health nor the safety of the workers, although great efforts have been made to assure the health and safety of consumers, driven of course by the requirements of export markets.

A number of possible areas can be suggested for improvement in order to move towards achieving the social objective. First, the legal and judicial framework within which the industry operates needs to be developed further. It would also be useful to undertake awareness-building campaigns to promote responsible fishing practices, coupling these where possible with some kind of market incentive to encourage the adoption of appropriate practices and the abandonment of inappropriate ones. Pilot projects to reduce discarding and post-harvest losses generally would be useful, although once again these should not be limited to technical solutions but should also consider economic/market mechanisms to persuade or dissuade as appropriate.

As in the case of Mauritania, success is limited in the case of social goals in Senegal. Efforts have been made to reduce post-harvest losses (construction of well-equipped fish markets, cold chain, improvement of some processing sites, and the development of a distribution network). Nonetheless, most of the work remains to be done, especially for artisanal processing where problems of hygiene and quality are keenly felt.

As regards working environment, the current situation is simply one of failure to achieve social goals.

There is currently no policy to promote aquaculture, although an institutional framework does exist (creation of a Department for Inland Fisheries and Aquaculture).

Difficulties and obstacles to be overcome relate to a number of factors in each broad area:

- **Utilisation of fish production:** inadequate sanitation systems at processing sites, illiteracy and the lack of training of the women responsible for processing and their lack of financial resources to modernise processing equipment, and the lack of status of women which tends to inhibit female entrepreneurs.
- **Safety:** traditional fisher education which runs against the use of safety equipment in general and lifejackets in particular, inadequate training of fishers on safety matters, weakness of institutional structures in charge of safety (human and technical resources).
- **Health:** weaknesses in the health system in general affecting all economic sectors (cost of medicines, lack of prevention, weaknesses in hospital structures, and absence of social security). These difficulties are probably worsened by certain features of fishing such as the physical harshness of the work and the rural nature of many fishing areas.
- **Equity:** natural reticence on the part of fishers to perceive the resource as a good which must be shared following access rules.
- **Aquaculture:** lack of technical mastery of the problems and poor perception of cost-benefit related to the activity.

Given these difficulties and obstacles, it is possible to identify a number of key needs in order to achieve social goals. These needs relate to training, public investment, credit, information, safety education and awareness, improved fishing equipment, social security, improved sanitary controls and conditions, restricted access and extension programmes concerning aquaculture techniques.

Important instruments which are currently absent or insufficient include an efficient mechanism to plan the activities of the State in fishing, effective credit institutions, mutual health institutions, an effective communication system and a mechanism to allocate fishing rights.

4.3 Economic objective

Discussion of the economic objective is more problematic. The analytical framework proposed for this and the other papers at the Bangkok Workshop describe the economic objective in terms of managing capacity, trade and IUU. This is a rather limited list but more importantly it is one that does not contain the key economic element: resource rent. The need to manage capacity arises in the first place because of a very widespread failure in fisheries management around the world to deal with the issue of resource rent (or, equivalently, to deal with the problem of free and open access).

A key question therefore, is whether anything can be learned from the experience of West African fisheries on this question as well as on the ones proposed by the analytical framework.

If the economic objective is restricted to the analytical framework vision, then the degree of success in Mauritania is very low. However, taking resource rent into account changes this judgement. Mauritania is a country which generates around 25 percent of its Government revenue from the fishing sector. This is an extraordinary performance, reflecting of course the economic importance of the sector, and matched by very few countries around the world. Until the mid-1990s, most of this revenue was generated by the Mauritanian fishing industry itself but a change in management system has meant that the Government has come to rely increasingly on foreign access agreements for this revenue. This change is rather unfortunate because it hamstrings the Government in the development of policy and of the sector.

Until the mid-1990s, the system was based around a State monopsony, whereby all fish that was frozen for export had to be sold through a State company, the SMCP. This system doubtless had defects but it also had strengths, not the least of which was that the small-scale sector made the same contribution (pro-rata to its catches) as the industrial sector (the trawlers) since all fishers paid their taxes on the value of their catch. For reasons that remain somewhat obscure, this system was dismantled in the 1990s and replaced by a licensing system. This latter was intended to generate the same revenue but it has not been able to do so, particularly for the small-scale sector, which has proven difficult to manage under a licensing system. As a result, the Government is faced with an unnecessary conflict in its objectives since on the one hand it wishes to maximise its revenues from the fisheries sector and on the other it wishes to promote the small-scale segment. Under the previous system, no such conflict existed.

This brief account may reveal one factor leading to unsustainability: the difficulty of recognising a good management system when one exists. Or perhaps the difficulty of agreeing what features a good management system should have. The system based around the SMCP was "good" if one thinks that extracting resource rent is an important part of the economic objective; it is not so "good" if one thinks that monopsony is inherently bad and that competition must somehow be created. The crucial requirements seem to be to agree what is the precise objective, and then to be imaginative in seeking solutions.

The attempt to manage capacity has been unsuccessful. A working group of the research institute (then CNROP, now IMROP) in 1998 suggested that effort needed to be reduced by 25 percent in the octopus fishery. As a result the Government implemented a series of measures referred to above, including the effort freeze and closed seasons. These measures seem to have largely failed since the most recent IMROP working group (December 2002) estimates that the effort reduction required is now 30 percent.

Many factors can be cited to explain the problem. Mauritanian fishers, as represented by the Federation, are convinced that the problem arises because of the European fleet fishing under the recent fishing agreement. Although at first sight this appears a reasonable explanation, the situation is complicated and difficult to evaluate - for instance, the EU fishers do not fish the same zone as Mauritanian fishers. It is probably more accurate therefore, to attribute the failure to a range of the factors of non-sustainability, including the following.

- **High demand for limited resources**. This particular problem explains both the difficulty of reducing national capacity and the demand for access on the part of foreign (EU) capacity. Prices are variable but recently have been rising, aggravating the situation.
- **Poverty and lack of alternatives**. Certainly for the small-scale sector there are few alternative activities. However, there are alternative fisheries. One (potential) advantage of the old SMCP-based management system was the ability (not in fact used in this way) to alter prices to provide incentives to encourage movement away from one species and towards another. Under licensing it has proven difficult to achieve this, although a specific cephalopod licence has now been introduced. Only time will tell if this is sufficient, although experience with licensing elsewhere suggests it is unlikely to be so.
- **Complexity and inadequate knowledge (social, economic, bio-ecological)**. As mentioned above, it is difficult to establish for instance the true impact of the fishing agreement given that fishers fish in different areas. The biology and life cycle of the octopus does not yet seem well enough understood.
- A final factor, which perhaps comes under inappropriate incentives, is that the **Government lacks the financial resources to pay fishers to quit the industry (trawlers in particular)**. As a result, when things go badly, people may stop fishing but they tend to keep the licence alive (but dormant). As soon as the fishery recovers, these dormant licences may be resurrected. Achieving true capacity reduction is therefore a difficult exercise.

The factors identified suggest the kinds of solutions that might be adopted. Overall, the management framework needs to be improved. A key requirement is to identify instruments that will enable fishing capacity and fishing effort to be brought under effective control. These instruments have to be able to apply to a very diverse fleet, ranging from very small artisanal vessels hauling pots, to large freezer trawlers. Licence based systems are notoriously difficult to operate in such circumstances. Systems based on common denominators (the fish, or the money) may have more chance of success.

There is a need to consider the macroeconomic role of the fisheries sector. Where poverty and lack of alternative employment is a problem, it is understandably tempting to use the sector to create jobs and economic activity in general. However, there is a need to consider the limits to such a policy provided by the natural limit of the resource, if by nothing else. A more appropriate long-term policy may be to use the fishing industry (through rent extraction) to fund investment in other productive activities, but this depends on the economy being able to provide appropriate investment opportunities.

Whatever system is adopted, it will require sufficient financial resources to operate effectively.

In Senegal, the overall assessment is that economic goals have not been achieved. A number of difficulties and obstacles can be identified relating to each of the broad themes raised in the terms of reference.

The key problem with the objective of bringing catching capacity into line with the opportunities offered by the resource is once again the absence of a system to define and attribute use rights within fishery management plans. Another factor is the lack of technical and human resources to carry out MCS activities, together with the failure to involve fishers in such activities to try to improve compliance levels.

The application of WTO rules meets a number of problems. Subsidies were initially implemented for two reasons: to increase production by reducing investment and operating costs, and to ensure the availability of fish at reasonable prices on the local market. Removing subsidies will likely have the opposite effects, with increased costs leading to some fishing operations being unable to survive, and prices perhaps increasing. These threats make attempts to remove subsidies unpopular. The issue of marketing illegally caught fish turns on the ability of the MCS and inspection authorities to carry out their functions.

The main needs in order to achieve economic goals relate to the fishery management system itself, both in its conception and its implementation. Support is needed to define an appropriate method to allocate fishing use rights and to regulate access to the resource. Institutional reform is also needed in order to support fishery management with a strengthening of human and technical resources for both research and administration.

The principal instruments that are needed are fishery management plans and an appropriate fiscal policy for the fishery sector.

4.4 Institutional objective

The institutional objective is somewhat different in nature to the other objectives. In many ways, it is not an objective for its own sake but is intended to serve the achievement of the other objectives. The section above on the bio-ecological objective already discusses the main institutional issues and constraints in the case of Mauritania. In addition to the solutions discussed there, it is possible to identify some other key aspects.

First, a precautionary approach has been adopted resulting in fishing effort being frozen at its current level for heavily exploited species as well as for those for which current knowledge is inadequate. This is the case for demersal species on the continental slope, for mullet, for hake, for coastal shrimp and for crab. The biological rest period instituted for octopus is also of a precautionary nature.

Second, a monitoring system has been established involving a range of participants, including:

- DEARH - responsible for collating statistical data from 5 main sources: the MCS directorate, customs, SMCP, the Central Bank and the IMROP (research institute). A computer network has been established and a centralised database is being set up;
- IMROP - statistical data on the small-scale sector obtained from bi-annual censuses involving the whole coastline coupled with surveys by métier in Nouakchott and Nouadhibou (the principal fishing ports);
- Fisheries Directorate - information on fishing rights;
- Merchant Marine - information on maritime security;
- DSPCM - (the MCS directorate) has detailed data from logbooks, although this system does not yet cover the small-scale and coastal sectors;
- SMCP - (the state monopsony) has data on cephalopod exports.

Third, Mauritania and Senegal collaborate with other countries in order to promote responsible fishing. Both are members of the sub-regional fisheries commission (together with Gambia, Guinea, Guinea Bissau, and Cape Verde). Mauritania currently acts as President of the Council of Ministers. In the context of IUU fishing, co-operative efforts have been undertaken including:

- Agreement between Mauritania and Senegal to fight illegal fishing;
- Agreement between Mauritania and Cape Verde to fight illegal fishing;
- Combined operations between Member States to undertake marine surveillance operations.

In the case of shared small pelagics, Mauritania and Senegal are developing, with the help of IUCN, a joint project to conserve mullet and courbines.

In Mauritania, a variety of fishing agreements exist, notably with the EU, China, Russia, Ukraine and Lithuania. These agreements often include an element of institutional support, concerning for instance research and training. Mauritania also has a bilateral fishing agreement with Senegal.

Within the framework of the SFLP/FAO programme, Mauritania has undertaken a number of activities, including:

- a national seminar to raise awareness of the FAO Code of Conduct for Responsible Fisheries;
- a number of training sessions for small-scale fishers.

The need to take fishing into consideration in coastal area planning is recognised. In the development of offshore petroleum exploration, the needs of the fishing industry had to be taken into account. And the Government has recently forbidden such exploration in the neighbourhood of the Banc d'Arguin National Park.

In Senegal, a number of constraints may be identified that inhibit the achievement of the institutional objective. Such constraints include the following.

- Scientific information is often inadequate or absent due to the failure to carry through research programmes. This failure relates to inadequacies in personnel and funding. There is also a failure to define research priorities appropriately, at least from a fishery management perspective. Statistical data are also lacking, due to incomplete coverage both territorially and sectorally due to insufficient human resources. The situation is worsened by a lack of trust between administration and research on the one hand, and the industry on the other which makes it difficult to collect good information; and there has been little attempt to build bridges between traditional knowledge and scientific information.
- Implementation of the precautionary approach is difficult due to the lack of authority of the management agencies. The inability to install a biological rest period for the resource due to the hostility of the profession is one example.
- The issues of transparency and participation are clouded by the failure to define an adequate basis for the allocation of use rights. As a result, conflicts concerning access to the resource are often resolved in ways which raise issues of equity. The principle of participation is increasingly adopted but its practical implementation suffers from the fact that representatives from the profession often do not represent the general interest. The discretionary power of the Minister (granting licences) and the Administration in general (for instance, concerning the way in which infractions are punished) tends to restrict the transparency of decision-making systems.
- Collaboration with other countries in the sub-region could be improved through a more effective regional collaborative arrangement (strengthening the Sub-Regional Fishery Commission) and through a decrease in the disparity between national MCS systems.
- Promoting responsible fishing through training and awareness building is not a sufficiently high priority. The authorities have tended to give more importance to creating fisheries infrastructure, establishing funding mechanisms and giving fiscal flexibility to the fishers. A re-examination of priorities seems required.
- Less and less attention is paid to the fishing interest in coastal area management because of the increasing importance given to building for hotels or private dwellings.

The main needs relate to institutional reform so as to improve fisheries management, to adequate funding of MCS, and to information education and awareness-building around the theme of responsible fishing. There is also a need to pay more attention to fisheries issues in coastal area management.

5. CONCLUSIONS

The discussion above suggests that both the Mauritanian and Senegalese governments have come to recognise the need for management of fishery resources in order to ensure that they make an appropriate contribution to social and economic development. The objectives set out in various international fisheries instruments have been broadly incorporated into key policy documents, although progress continues to be required concerning social issues. The issue of economic objectives also warrants some discussion since the crucial issue of resource rent appears not to feature in the international instruments, let alone national policy.

In both countries the key issues are found not in the area of objectives but in the area of policy implementation. As progress is being made towards establishing systems based on fishery management plans to achieve the objectives, needs for technical assistance are gradually being clarified. These needs are discussed throughout the paper. The key issues appear to relate to financial, logistic and human resources for the structures responsible for research and planning and it is in these areas that technical assistance would appear to be most fruitful.

DISCUSSION PAPER 11

THE CASE OF DEVELOPING COUNTRIES

by

Philippe Cacaud[117]

Summary

An increasing number of developing countries have adhered to international fisheries instruments over the past few years. Implementation of these instruments is a formidable challenge for the fisheries authorities of these countries, which in most cases suffers from a lack of human and financial resources. Application of the four components of sustainability shows that developing countries have, so far, been unable to translate fisheries management principles into effective management actions. Lack of good governance in all dimensions of fisheries management was identified as the principal obstacle to achieving sustainability. It was argued that unless this issue is addressed, it would very difficult for developing countries to improve significantly the effectiveness of fisheries management.

1. INTRODUCTION

The purpose of this paper is to examine whether developing countries have been able through the implementation of international fisheries instruments to address effectively the main factors contributing to unsustainability and overexploitation that were identified and discussed in the framework of a first workshop organized by FAO in February 2002[118]. The approach elected to carry out this objective consisted in analyzing the way fisheries management is conducted in two countries familiar to the author and where fisheries is significant both economically and socially, namely, Senegal and Indonesia.

In recent years, international initiatives have led to the improvement of the international legal and policy framework for fisheries management through the adoption of international fisheries instruments and the establishment of regional fishery bodies. An increasing number of developing countries have, over the past few years, ratified or adhered to major international fisheries instruments and become members of regional fishery bodies. This trend is encouraging as it reflects developing countries' interest in strengthening regional cooperation and in improving international fisheries management.

The present document aims to: identify the main constraints faced by developing countries in implementing international fishery instruments; assess the extent to which the implementation of such instruments has contributed to lessening the impact of the main factors of unsustainability and overexploitation; and suggest steps towards sustainability.

2. DIFFICULTIES AND OBSTACLES TO EFFECTIVE IMPLEMENTATION OF MAJOR EXISTING FISHERIES INSTRUMENTS

This section attempts to identify the main difficulties and obstacles that developing countries are confronted with in implementing major fisheries instruments. To this end, the present document examines whether fishery management in developing countries is successfully achieving the four components of sustainability as identified by the first workshop: bio-ecological, social, economic and institutional.

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[117] The views expressed in this paper are solely those of the author, Philippe Cacaud, consultant, Viry, France, pcacaud@aol.com.

[118] See: "Report and Documentation of the International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries (Bangkok, Thailand, 4-8 February 2002) ". FAO Fisheries Report, No. 672. Rome, 2002.

2.1 Bio-ecological component of sustainability

Analysis of national fishery policies and fishery laws and regulations shows that main bio-ecological objectives embedded in major international fishery instruments, such as the need to protect, conserve, and restore fishery resources, the marine environment, habitats, ecosystems and biodiversity, the need to create the conditions capable of producing the Maximum Sustainable Yield (MSY) as well as the need to take all necessary measures to avoid overexploitation are widely recognized. While it is fair to say that the bio-ecological aim enshrined in international fishery instruments is generally well understood by fishery authorities, this may not be necessarily so at the grass-root level. Indeed, local fishers may not be aware of the importance of such issues as well as their implications on their livelihood and thus not fully understand where their long-term interests lie. In a context of fierce competition, as is often the case in coastal areas, awareness, however, may not necessarily be conducive to responsible fisheries practices, as some fishers may feel compelled to use harmful fishing methods in order to survive. Therefore, while the degree of awareness tends to vary in relation to the education level of each individual fisher, use of responsible fishery practices by local fishers depends primarily on the local context and on their ability to make a decent living by using such practices.

While the need to protect the marine environment, habitats and marine ecosystems is generally recognized in recent fishery legislation, one notes that the inclusion of such principles in the law does not necessarily carry any legal implication. Hence, management institutions and fishers may not feel compelled to abide by them.

So far, protection and conservation of marine biodiversity and ecosystems through the establishment of marine parks or other types of protected areas have had limited success in developing countries as most of them do not have the necessary means to implement and enforce the conservation and management measures provided for in the management plans for these areas. Likewise, implementation of conservation and management measures prohibiting the use of harmful fishing gear or methods has proved difficult to achieve.

Regional fishery bodies have been instrumental to the promotion of the main bio-ecological aims of fisheries management at the regional level, notably, through the organization of workshops on specific aspects of fishery management. They provide a forum of discussion where experiences can be shared amongst fishery managers and where strategies to ensure implementation of international instruments at the regional level can be developed. In this regard, one should point out that regional plans of action for the protection of certain species such as sharks have been adopted in certain areas. National plans of action, however, have yet to be developed in most developing countries.

While there is a general consensus on the need to improve fishing gear selectivity and to promote environmentally safe fishing gear and methods, little has been done so far to achieve these goals. Moreover, too many legal frameworks still do not provide sufficient safeguards to prevent the introduction and use of harmful fishing gear or methods.

Few conservation and management measures have been adopted to address the issues of by-catch and discard and to ensure the conservation and protection of associated species. Lack of adequate data gathering systems prevent fisheries authorities from measuring the impact of these issues. Some States, however, have taken action by enacting regulations prohibiting discard and restricting the amount of by-catch that can be landed in specified fisheries.

2.2 Social component of sustainability

2.2.1 Safety at sea

In recent years, improvement of safety at sea in small-scale fisheries has come to the forefront of fisheries management in many developing countries. Increasing competition for dwindling resources has led many small-scale fishers to fish further out at sea increasing risks of collision with industrial fishing vessels and merchant ships. Small-scale fishing vessels are generally poorly equipped, lacking the most basic safety equipment such as life vests, radio HF or radar reflectors. In the face of frequent losses of life at sea, many governments have launched safety-at-sea programs with the support of foreign aid and have introduced regulations requiring small-scale fishing vessels to meet minimum safety and seaworthiness standards. Typically, such regulations require that safety vests, lights, radar reflectors, fire extinguisher, first-aid kit and anchors be carried on board. GMDSS pilot projects aiming at establishing GMDSS centres and at equipping all small-scale fishing vessels with a radio HF and EPIRB are tried in certain areas. Despite all these initiatives, much effort remains to be made to make these programs fully effective. The fact that small-scale fishers are often poorly organized compounds the implementation of such programs. Lawmakers in some countries have envisaged introducing regulations conditioning access to fisheries by small-scale fishing vessels to compliance with safety and seaworthiness standards as is required for industrial fishing vessels. In practice, high degree of compliance with such measures is unlikely unless small-scale fishers understand the benefits they can derive from such measures and required equipment is made affordable.

Loss of life at sea is a frequent occurrence in fishing communities and may have enduring social implications on the families of deceased fishers. Although many communities still rely on traditional solidarity systems to support the families of deceased fishers, these mechanisms often prove insufficient to sustain these families in the long run. Hitherto, banks or other financial institutions have failed to devise insurance products tailored for the needs of small-scale fishers.

2.2.2 *Fair and healthy working conditions*

While it is the duty of governments to ensure fair and healthy working conditions for fishers, rules governing living and working conditions on board fishing vessels have yet to be developed in many developing countries. Absence of legal protection results in living and working conditions on board fishing vessels often not satisfying internationally agreed standards. In addition, it prevents fishers from taking legal action. Furthermore, it should be emphasized that fishers' social and legal status are often ill-defined as lawmakers, in many developing countries, have failed to specifically address this issue.

Lack of organization, in particular in the small-scale fisheries sector, prevents fishers from influencing decision makers effectively and thus from protecting their rights efficiently.

2.2.3 *Quality and safety of fish and fishery products*

In many developing countries, quality and safety standards to be applied to fish and fishery products depend on whether such fish and products are to be exported or consumed locally. For the former, stringent quality and safety standards modelled after those applicable in the targeted markets apply. Countries such as the United States of America, Japan and the European Union impose drastic quality and safety standards on fish and fishery products to satisfy local consumers and require that all imported fish and fishery products meet these standards. By contrast, few quality and safety standards governing the harvesting, handling, processing and distribution of fish and fishery products have been developed in the latter.

Profitability is the driving force behind the enactment of regulations governing safety and quality of fish and fishery products in many developing countries, as such fish and products fetch much higher prices in the US, Japanese or EU markets than in local ones. In the meantime, little attention, if any, has been paid to the need to improve the safety and quality of fish and fishery products in local markets, even though harvesting, handling, processing and distributing practices are recognized to be of low standards. Some countries have been as far as introducing EU or US regulations in their national legislation without adjusting them to the local context. As a result, such rules are totally inapplicable locally, except for a few fishing companies and processing plants targeting foreign markets. Failure to set appropriate quality and safety standards for fish and fishery products traded in local markets adversely affects public health and the general well-being of populations.

2.3 Economic component of sustainability

2.3.1 Management of fishing capacity

It is the duty of coastal States to ensure that the fishing capacity deployed in their waters is commensurate with the productive capacity of the fishery resources, the environment and the ecosystem. To this end, States are required to assess the fishing capacity of all the fleets of principal fisheries, including foreign vessels duly authorized to operate therein, and to update this assessment periodically. Fulfilling this obligation is likely to be a challenge for many developing countries provided that few systematically register or record small-scale fishing vessels and that accuracy of information entered into industrial fishing vessels registers is questionable, as there is no local expertise to verify the accuracy of such information. It is widely recognized, for instance, that many industrial fishing vessels' recorded tonnages are understated or false. Failure to register or record small-scale fishing vessels combined with recording of unreliable data on the industrial fishing fleet are likely to distort the overall assessment of fishing capacity. This may in turn prompt fisheries managers to make wrongful conclusions and propose inappropriate national plans of action for managing fishing capacity. Inaccurate assessment of fishing capacity at the national level is also likely to affect effective management of fishing capacity at the regional level.

Most developing states do not have the financial and human means to ensure a systematic and accurate monitoring of the fishing capacity.

Where required, reduction of fishing capacity may be difficult to achieve, in particular in areas where alternative sources of employment and livelihood for fishing communities are not readily available.

2.3.2 Trade of illegally-caught fish

States have a duty to prevent, deter and eliminate IUU fishing. To this end, they are required, among other things, to take all necessary measures to prevent fish caught by vessels engaged in IUU fishing from being traded or imported into their territories. While regional commitment to combat IUU fishing has been forcefully proclaimed in certain areas, actions to make this commitment effective have yet to be undertaken at the national level. Little has, indeed, been done to devise or strengthen national strategies and procedures for port State control of vessels involved in fishing and related activities. Appropriate links and cooperation mechanisms between port and fishing authorities, which are critical to make control and monitoring effective, are still lacking.

Most States have yet to review their legal framework to ensure that it provide fisheries managers and law enforcement officers with all the necessary legal tools to prevent and deter IUU fishing.

2.4 Institutional component of sustainability

2.4.1 Data gathering and management advice

Lack of sufficient and reliable scientific information to evaluate the state of the fishery resources is a major problem hampering the devising of conservation and management measures, the development of fisheries management plans and the determination of Total Allowable Catch (TAC). Uncertainty may lead to wrongful managerial decisions.

Research programs in support of fishery conservation and management are not always properly tailored to the needs of fisheries managers and policymakers.

Funding is generally insufficient to ensure the sustainability of research programs in support of fishery conservation and management. Scarcity of financial resources results in research programs being discontinued at times and/or heavily dependent upon foreign aid through execution of projects. Needless to say that irregular funding of research programs undermines the effectiveness of fisheries management.

Tools and procedures to ensure timely, complete and reliable collection of statistics on catch and fishing effort have been established through laws and regulations. Keeping of logbook and position reporting by industrial fishing vessels are required in most developing countries. Maintenance of collected information, however, does not always comply with applicable international standards and does not always provide sufficient information to enable sound statistical analysis. In this regard, it should be emphasized that developing countries often lack appropriate software programs and the necessary expertise to perform meaningful analysis of the collected data. Oftentimes, updating of data lags behind and no appropriate data verification system is designed, thus encouraging underreporting and misreporting of catch. Moreover, no proper safeguards designed to ensure confidentiality of collected information, including access, use and disclosure, have been developed.

Collection of complete and reliable statistics on catch and fishing effort from small-scale fisheries is a major problem due, *inter alia*, to the difficulty for understaffed fishery authorities to control scores of landing sites and to the high rate of illiteracy amongst small-scale fishers. It should be pointed out that provisions pertaining to data collection provided for in fisheries laws and regulations are primarily aimed at industrial fishing vessels. Few, if any, rules designed to ensure collection of data from small-scale fisheries are devised. Where such rules have been enacted, one notes that it is generally extremely difficult to implement them satisfactorily. In certain areas, local and regional projects have contributed to the strengthening of data collection systems from small-scale fisheries. However, ensuring the sustainability of such systems in the long run remains a challenge in most developing countries.

Socio-economic studies generally sponsored by foreign aid have contributed to improve knowledge and understanding of socio-economic issues in the fishery sector and to the taking into account of social and economic factors in fishery management. However, there is no systematic gathering and analysis of socio-economic data.

2.4.2 Management framework

2.4.2.1 Fisheries management plans

It should be pointed out that broadly stated management objectives, enshrined in developing countries' fishery policies and basic fisheries laws, are rarely translated into management actions. In this regard, it is interesting to note that many fisheries legislation make it a legal obligation for the competent authority to devise comprehensive fisheries management plans and to review them periodically. Experience has shown, however, that most developing countries have yet to develop such plans. Meanwhile, developing countries have adopted general management measures applicable throughout their waters without specific reference to particular fisheries. Lack of reliable scientific data and insufficient knowledge explain to a large extent why many developing countries have failed to draw up fisheries management plans. Lack of local expertise, complexity of multispecies fisheries, and lack of political will are other factors contributing to this situation.

Mechanisms to evaluate policies and management performance have rarely been put into place thus failing to create proper incentives to improve fisheries management.

2.4.2.2 Planning of coastal areas' multiple uses

The extent to which fisheries interests are taken into account in the multiple uses of coastal areas and are integrated into coastal area management, planning and development varies from one country to another. It depends essentially on the political weight of fishing communities and producer organizations, on the socio-economic importance of the fisheries sector in the country and on the ability of the fisheries department to ensure that the fisheries sector is recognized as a legitimate user of coastal areas. Formal mechanisms designed to ensure that all interests are fairly taken into account and properly balanced in the management of coastal areas have yet to be devised.

Adequate protection of marine ecosystems, habitats and biodiversity cannot be achieved unless all users of the marine environment cooperate with a view to reaching that goal. It is therefore the duty of governments to facilitate the achievement of that goal through the establishment of proper consultation mechanisms and decision-making processes and through the devising of effective linkages between all interested departments and authorities. Ultimately, such action may translate into the development of an integrated coastal zone management plan. So far, many governments have failed to coordinate the actions undertaken by all interested departments and authorities so as to ensure that a global and integrated approach to the protection and the conservation of the marine environment is applied. Environment is, to some extent, still perceived as a preoccupation of rich countries and therefore is not yet regarded as a priority in many developing countries.

In order to secure the long-term exploitation rights of aquaculturists, it is critical that governments ensure the taking into account of aquaculture interests in the multiple uses of the coastal zone and their integration into coastal area management, planning and development.

2.4.3 Legal and administrative framework

Implementation of major international instruments generally requires that States translate their international rights and duties under such instruments into national legislation. This process may be slow at times and result in time-lag, which is a major impediment to effective implementation of international instruments.

2.4.3.1 Access conditions

Most coastal States have opted to restrict access to their fishery resources through the establishment of a licensing system. Such a requirement is generally applicable to all industrial fishing vessels, whether foreign or national, operating within waters under national sovereignty or jurisdiction and also, but not always, to small-scale fishing vessels. In certain areas, where fishing communities are well-organized and politically influential, governments may be reluctant to subject small-scale fishing vessels to a licensing regime. The need to maintain peace may also prevent the introduction of such a regime in other areas. In countries where a license is required for any small-scale fishing vessel, implementation of such a requirement has often proved difficult, if not impossible, to achieve due, notably, to the failure of the administration to systematically record small-scale fishing vessels and to the lack of understanding of such a measure by fishing communities. In this regard, one should not underestimate the fact that the need to first obtain a license to fish in the sea area adjacent to coastal villages is a concept still foreign to many fishing communities where freedom of fishing, and thus free and open access to fisheries, is a long-standing principle. Non-compliance to such a requirement is also the result of the fisheries authorities being often ill-prepared to carry out that task.

Recent fisheries legislation generally subject flag vessels to an authorization regime to fish on the high seas or in the waters under the sovereignty or jurisdiction of a third party. Some developing States, however, object to the inclusion of such a requirement in their fisheries law on the ground that it is irrelevant since no flag vessels undertake any fishing operation on the high seas and/or that it is the duty of the coastal state in the waters of which a flag vessel wishes to fish to ensure that vessels operating therein comply with applicable legal requirements. Few developing States, even where a special authorization to fish on the high seas is required under national law, are able to exercise effectively their jurisdiction and control over such vessels. Data on catches on the high seas are scarce. Where existent, competent authorities have no means to verify their accuracy. So far, few States have established and maintained an up-to-date national record of fishing vessels authorized to fish on the high seas, making the goal of establishing a regional register or record of fishing vessels difficult to achieve.

Access by foreign fishing vessels to fisheries under national sovereignty or jurisdiction is generally allowed through fisheries agreements concluded between States or through chartering arrangements. It should be no surprise that, in cash strap countries, conclusion of fisheries access agreements is, at times, dictated more by the prospect of making short-term financial gains rather than based on managerial considerations. Such approach runs counter to fisheries management principles and is likely to affect the long term sustainability of fishery resources. It may also adversely impact the livelihood of small-scale fishers.

Few measures have yet been taken by developing States to ensure that flag vessels do not engage in IUU fishing. In particular, little has been done to avoid flagging vessels with a history of IUU fishing. Likewise, not enough attention is paid to vessels' previous history, when deciding whether to grant such vessels an authorization to fish within waters under national sovereignty or jurisdiction.

2.4.3.2 Decision-making process

In recent years, many developing States have introduced mechanisms designed to ensure transparency in decision-making process and procedures to facilitate involvement of interested parties in the development of laws and policies related to fisheries management. Participation of fishers in law enforcement has also been experimented in some countries. While it is too early to measure the extent to which the introduction of such mechanisms and procedures has improved fisheries management's effectiveness, it is clear that fishing communities have shown a great deal of interest in being involved in the decision-making process. General discussions and debates leading to the establishment of participatory mechanisms and consultation procedures have revealed that whatever the form of the mechanisms proposed meaningful participation of interested parties must be ensured to improve confidence in the management system and willingness to support conservation and management measures.

Lack of transparency in the license allocation process is likely to undermine the effectiveness of the management system.

2.4.3.3 Monitoring, control and surveillance

It is the duty of States to ensure compliance with and enforcement of conservation and management measures and establish effective mechanisms to monitor and control activities of fishing vessels. To this end, many coastal States require that duly authorized industrial fishing vessels be registered and properly marked, maintain a logbook, undertake regular technical visits, embark observers on board and communicate their geographical position regularly. Satisfactory implementation of such measures has proved difficult to achieve for most developing countries due to well-known constraints, particularly lack of financial and human capacity. For a long time, monitoring and control measures were primarily directed at industrial fishing vessels, while little attention was paid to small-scale fisheries. Lately, however, the need to control and monitor the fishing effort of small-scale fishing fleets as well has been increasingly recognized. So far, few countries have managed to systematically register and mark their small-scale fishing vessels. Lack of monitoring and control of small-scale fisheries combined with increasing competition result in very low compliance with conservation and management measures by small-scale fishers.

Many coastal States impose duly authorized foreign fishing vessels and often, but not always, certain categories of flag vessels to take on board one or two observers when operating within waters under national sovereignty or jurisdiction. Running of observer programs is costly and developing States do not always have the capacity to ensure that observers are adequately qualified to carry out their tasks and receive proper financial incentives to perform their duties honestly. In addition, observers' status is not always well-defined as they are often employed on a contract basis and thus are not part of fishery authorities' staff. Furthermore, considering the risks to which observers are exposed, States do not always provide them with sufficient legal protection.

While recognized as a key component of MCS system, surveillance at sea, using traditional means (surface and aerial surveillance), has proved way too costly to operate for developed and developing countries alike. Over the past decade, more and more developing States have opted to install a vessel monitoring system (VMS) using satellite communications to improve the cost-effectiveness of surveillance at sea. Introduction of VMS has sparked a shift in surveillance strategies and led management authorities to rethink the way of using traditional means of surveillance in support of VMS. So far, however, most developing States have failed to establish proper mechanisms to coordinate actions by the fishery authority, the Navy and the Coast Guards (both being responsible for law enforcement at sea and owners of patrol vessels).

It is widely recognized that in port monitoring and control of fishing fleets is critical to deter IUU fishing and trade in illegally caught fish. It appears, however, that little has been done to improve in port monitoring and control procedures in developing countries as focus of fishery authorities is primarily directed at acquiring new technology through the installation of VMS. Monitoring and control of small-fishing activities is virtually inexistent.

Although many developing coastal States have enacted legislation providing for the protection of marine ecosystems and biodiversity from marine pollution and have designated competent authorities for administering such legislation, few actions have ensued. As a consequence, nowadays few States have the capacity to monitor the state of the marine environment and are adequately prepared and equipped to prevent, mitigate and combat marine pollution (e.g. development of contingency plans, acquisition of equipment). Moreover, failure to establish such monitoring systems also undermines States' ability to protect public health effectively.

Aquaculture contributes to the diversification of income in many developing countries. Shrimp aquaculture, for instance, is a lucrative business in Asia. Development of this activity, however, has had some adverse impacts on the environment in coastal areas. Large swaths of mangrove, for example, have been destroyed in order to dig ponds for shrimp farming. Degradation of water quality has occurred in some areas due to aquaculture activities (dejection of farmed animals, use of chemicals, wastewater discharge). Escape of genetically modified organisms is also a potential threat to the local biodiversity and the balance of marine ecosystems. While an increasing number of developing States has improved the legal framework governing aquaculture activities by requiring, for instance, environmental impact assessment prior to authorizing the exploitation of fish farms, by imposing restriction on the use of chemicals, and by subjecting use of fresh water, wastewater discharge, and movement of farmed species to authorization systems, a lot remain to be done to strengthen technical controls of aquaculture activities and make them fully effective.

2.4.3.4 Law enforcement

It is the duty of States to ensure that their legislation provide for adequate sanctions in respect of violations. Imprisonment, which was a common feature of fisheries law adopted in the eighties, has been struck out of most recent fisheries legislation, while fishery authorities have been empowered to refuse, withdraw or suspend licenses in the event of non-compliance with conservation and management measures. The threat of having their license withdrawn or suspended is a potent deterrent for fishers as it prevents them from going to sea and hence from generating revenues. However, lack of enforcement and lack of appropriate procedures to ensure transparency in decision-making and thus avoid arbitrariness undermines the effectiveness of this approach in many countries.

To ensure swift decisions and thus avoid the lengthy procedures of court proceedings, lawmakers have, in an increasing number of countries, introduced, in their fisheries legislation, mechanisms providing for out-of court settlement. These mechanisms allow designated authorities to compound all or certain categories of offences. Lack of adequate procedures and proper safeguards to ensure transparency and fairness in decision-making has unfortunately led to arbitrary decisions. It should be pointed out that in certain countries, where there exists general distrust in the judicial system, use of compounding has replaced court decisions.

Rules of evidence are generally given little attention by lawmakers in fisheries legislation since general rules defined in criminal and civil law are generally applicable. Use of new technology in fisheries management requires that States develop new sets of rules to specify the evidential value of information generated by the new technology (e.g. VMS position reports).

While water pollution generated by fishing vessels or fish farms is an offence under the fisheries and aquaculture laws of some countries, few make the destruction or degradation of ecosystems or habitats caused by such activities (e.g. use of explosives or noxious substances) an offence and provide for the restoration of the resources, ecosystems or habitats that may have been adversely affected. Although remedy may be sought under environmental legislation, it would be useful to incorporate language dealing with this issue in fisheries laws.

Lack of regional or sub-regional cooperation in monitoring, control, surveillance and enforcement (MCSE) undermines the effectiveness of law enforcement of individual coastal Sates, especially with regard to IUU fishing.

2.4.4 Precautionary approach

Recent fishery policies and legislation require decision makers to apply the precautionary approach to conservation, management and exploitation of fishery resources. In practice, too many fishery managers still postpone or fail to take conservation and management measures on the ground that no sufficient and reliable scientific evidence is available.

Few States have developed a global strategy to implement the precautionary approach.

2.5 Cooperation to promote conservation and responsible fishing

As was noted at the first workshop, the focus of many international fishery instruments is on action at the regional level, primarily through the establishment of regional fishery bodies. In recent years, many regional fishery bodies have been created to enhance regional cooperation. Some of the existing regional fishery bodies are ineffective as they lack the proper financial resources to operate and lack effective participation by members. Failure of members, particularly developing countries, to discharge their responsibilities under international instruments is an issue of concern that needs to be urgently addressed.

Regional cooperation is critical to improve monitoring, control, surveillance and enforcement of fisheries management measures as the FFA example in the South Pacific region illustrates. Most regional fishery bodies promote the strengthening of regional cooperation in MCSE and advocates the development of regional VMS and the establishment of regional fishing vessels registers. While many States have expressed their interest in strengthening regional cooperation in MCSE, they have yet to translate their political commitment into action.

Bilateral agreements designed to improve management of shared stocks and MCS over both the industrial and small-scale fishing fleets have been signed in some areas of the world. Although such initiatives contribute to bolster sub-regional cooperation, their effects on fisheries management have, so far, not been significant as States often fail to discharge their responsibilities under the agreements.

The costs of implementing international instruments are prohibitive for some countries. Hence, in a context of proliferation of international agreements, some developing States are likely to opt not to participate in international instruments that they do not view as essential for their interests and by doing so may undermine regional cooperation.

Table 1. A summary of major difficulties and obstacles to implement major existing fisheries instruments by developing States (bio-ecological, social and economic)

Bio-ecological	Social	Economic
1. Lack of awareness and understanding or disregard of fishery management principles at the grass-root level 2. Most conservation and management measures aimed to protect and conserve marine biodiversity, habitat and ecosystems and to prohibit the use of harmful fishing gear and methods have to a large extent been ineffective 3. Few actions have been undertaken to improve selective and environmentally safe fishing gear and methods 4. Little has been done to address comprehensively the issues of discard and by-catch	1. Implementation of safety-at-sea program so as to reduce losses at sea has proved difficult to achieve 2. No insurance products tailored for the needs of small-scale fishers available 3. Absence or lack of legal protection to ensure fair and healthy working conditions on board fishing vessels 4. Social and legal status of fishers are ill-defined 5. Fishers are generally not sufficiently organized to influence effectively political decisions affecting their livelihood Failure to improve the quality and safety of fish and fishery products destined for local markets	1. Inability to manage fishing capacity effectively 2. Lack of economic alternatives impedes implementation of plans of reduction of fishing capacity 3. Ineffective port State control and monitoring procedures to prevent and deter IUU fishing

Table 2. A Summary of major difficulties and obstacles to implement major existing fisheries instruments by developing States (institutional component)

Institutional

1. Lack of sufficient and reliable scientific information undermines effective management
2. Sustainability of research programs in support of fishery conservation and management is not secured
3. Ineffectiveness of data collection systems and lack or absence of verification procedures
4. Lack of appropriate procedures to ensure confidentiality of data
5. Lack of appropriate mechanisms to ensure data collection from small-scale fisheries
6. Failure by management institutions to develop fisheries management plans as required by law and to devise mechanisms of evaluation of policies and management performance

7. No formal mechanism to ensure the integration of fisheries interests in the multiple uses of coastal areas
8. Failure to establish proper coordination mechanisms amongst all users of the marine environment undermines the protection of the marine ecosystems, habitat and biodiversity
9. Integration of aquaculture interests into coastal area management, planning and development is required to secure long-term exploitation rights
10. Limited-entry through licensing system is ineffective, particularly for small-scale fisheries
11. Inability of developing States to exercise effectively their jurisdiction and control over flag vessels authorized to operate on the high Seas or in third party waters
12. Access by foreign fishing vessels for short-term financial gains may undermine the long-term sustainability of the fishery resources
13. Failure to take action to prevent flagging and licensing of vessel with previous history of IUU fishing
14. Lack of transparency and meaningful participation of fishers in management system
15. Low compliance with management measures
16. Lack of safeguards to ensure effectiveness of observer programs
17. Lack of proper mechanisms of cooperation and coordination undermines surveillance effectiveness
18. Failure to improve in port monitoring and control procedures to deter IUU fishing
19. Failure to establish adequate monitoring system of the marine environment
20. Insufficient technical control of aquaculture activities
21. Lack of transparency and fairness in decision-making leads to arbitrariness in law enforcement
22. Distrust in judicial system
23. Review of rules of evidence in fisheries law
24. Inadequacy of the legal framework to protect and conserve marine biodiversity and ecosystems and to provide for appropriate remedy
25. Poor application of the precautionary approach
26. Failure of States to discharge their responsibilities under international agreements
27. Cost of implementing international instruments is prohibitive

3. WHY IS FISHERIES MANAGEMENT NOT SUCCESSFUL?

Participants in the first workshop noted that factors contributing to unsustainability and overexploitation are of a similar nature in almost all fishery systems and jurisdictions, if on a different scale and with a variable degree of importance. It identified six general categories of factors of unsustainability, namely, inappropriate incentives, high demand for limited resources, poverty and lack of alternatives, complexity and inadequate knowledge, lack of governance and interactions of the fishery sector with other sectors, and the environment. This section examines how main factors of unsustainability interact with the achievement of the bio-ecological, social, economic and institutional components analyzed in Section 2 of this document.

3.1 Inappropriate incentives

Lack of transparency and participation of fishers in the management system undermines confidence and willingness to comply with management measures. To tackle this problem, many States, under pressure from donor agencies, have initiated programs designed to introduce some form of co-management mechanisms. Whatever the form of the proposed institutional arrangements, it is crucial that meaningful participation be ensured. Mere consultation of fishing communities may fall short of what is expected and is likely to be interpreted as a ploy from the government.

In a context of economic hardship and overexploitation, conclusion of fisheries access agreements for short-term financial gains sends the wrong signal to local fishers and generates strong feelings of distrust in government actions. This is particularly true where no or little moneys derived from these agreements are used by governments to improve social and economic conditions of local fishing communities.

3.2 High demand for limited resources

Growing demand for fish in a context of limited sustainable supply may result in market price increase. Higher prices may, in turn, provide an incentive for intensifying exploitation and expanding fishing capacity further. Prospects of making financial gains are likely to intensify pressure on governments to allocate more licenses.

3.3 Poverty and lack of economic alternatives

Overcapacity of the small-scale fishing fleet is to a large extent responsible for overfishing in coastal areas. Programs of reduction of fishing capacity in already overexploited fisheries are unlikely to succeed as there are few, if any, alternative sources of employment and livelihood in coastal areas. Moreover, migration of population to coastal areas increases pressure on fishery resources and exacerbates competition for space. This movement of population is also likely to give rise to conflicts between long-established coastal communities and new comers.

3.4 Complexity and inadequate knowledge

The complexity of many fishery systems as well as inadequate knowledge and understanding make it hard for fishery authorities to identify the right course of action.

In small-scale fisheries, high rates of illiteracy among fishers make it difficult to collect sufficient and reliable catch data.

3.5 Lack of governance

To be effective ocean governance requires a high level of cooperation between interested departments at the central level and between the central level and other levels of government as well as proper coordination of actions undertaken by each legitimate department or authority. So far, many States have failed to establish appropriate mechanisms of cooperation and coordination to ensure effective ocean governance. One of the reasons is that sectorial departments have no tradition of cooperating with each other. In this context, cooperation relies more on individual networking than on formally established institutional cooperation mechanisms. Improved cooperation between the Fishery Department, responsible for issuing fishing authorizations, and the Shipping Department, responsible for the flagging of vessels, including fishing vessels, is required in most States so as to avoid re-flagging of vessels with previous history of IUU and inaccurate declaration of vessels' characteristics. Likewise, better cooperation is required between the Fisheries Department, the Navy and the Coast Guards to ensure compliance with management measures and law enforcement at sea. While the creation of environmental departments or agencies has been instrumental in improving the integration of environmental concerns in the devising of sectorial policies, much remains to be done to establish appropriate mechanisms designed to coordinate the actions of individual departments and agencies and to ensure their compatibility with the global environmental policy. Effective protection and conservation of the marine ecosystems, habitats and biodiversity can only be achieved through effective mechanisms of cooperation between all users of the marine environment.

Non-compliance with fisheries regulations is widespread and a major factor in unsustainability. A central issue for governments therefore is to identify the factors explaining non-compliance and to act upon them. Enacting ever more legislation and regulations is not going to solve the problem. Key elements that need to be addressed include: (1) ensuring widespread publication of enacted laws and regulations; (2) ensuring applicability of proposed measures; and (3) ensuring global coherence of the legal framework. Limited publication of laws and regulations results in their provisions not being well-known by fishers and enforcement agents alike. Too often proposed measures are inapplicable in the local context either because they have not been discussed with interested parties prior to their enactment or because they are not understood locally or are contrary to traditional practices. Another reason is that management institutions are not always ready to implement enacted laws and regulations (e.g. lack of implementing strategy) and/or do not have the necessary means to implement them.

Moreover, lawmakers must ensure the global coherence of the legal framework so as to avoid conflicting objectives (e.g. prohibition of using certain gear, while the importation and manufacturing of such gear is lawful).

Time-lag between the enactment of laws and regulations and their implementation undermines the timeliness and credibility of fishery management measures.

Poor law enforcement is a critical element in unsustainability. While financial and human constraints are partly responsible for lack of enforcement, other factors contribute to this situation. First, lack of cooperation amongst law enforcement departments and agencies undermines at sea and in port enforcement. Second, existing legal procedures are either insufficient or not scrupulously complied with (e.g. procedures governing arrest and release of vessels, report of violations, compounding). Third, lack of in-built legal safeguards in the decision-making process leads to arbitrariness (e.g. unchecked use of discretionary power).

Distrust in or deficiency of the judicial system results in criminal proceedings not being a deterrent. Indeed, it is not unusual in developing countries that law cases in fishery matters never reach the courts. While out-of-court settlement may be desirable to speed up the process, it should not be substituted to judicial review and should not lead to arbitrary decisions as is too often the case.

Mismanagement of qualified personnel is a common occurrence. Training programs proposed to local agents are not always relevant to the needs of the department.

Little attention has been paid by governments to provide conflict-resolution mechanisms to settle disputes among resource users whenever they cannot be settled within the community.

Transfer of excess capacity to other states or on the high seas is an issue of concern. In certain areas of the world, governments turn a blind eye to the illegal operations of their vessels outside their waters and in so doing fail to discharge their flag State responsibilities.

Adhesion to international agreements is at times a political gesture intended to send the right signal to the international community and donor agencies rather than a commitment to discharge responsibilities under the agreements.

Little attention has been paid to improve the social status of fishers and to provide them and their family with some type of insurance coverage.

3.6 Interactions of the fishery sector with other sectors, and the environment

It is a duty of governments to ensure a balanced and peaceful development of coastal areas. To this end, improved planning, management and development of such areas involving local communities and authorities and development of an integrated policy are required.

Proliferation of projects supported by foreign aid requires a better coordination at the national level so as to avoid conflict of objectives.

Activities of other sectors in coastal areas are likely to affect fisheries activities in one way or another (e.g. pollution, competition for space or resources). Since these factors are beyond the control of the fisheries sector, there is a need to integrate the impact of such activities in fisheries management and to take actions in order to mitigate their negative effects on fisheries activities.

4. HOW CAN THE DIFFICULTIES AND OBSTACLES BE OVERCOME?

The first workshop concluded that the main problem was not the lack of international instruments, but the lack of implementation of such instruments. One cannot agree more with this statement in particular for developing countries as shown in Sections 2 and 3 of this document. The workshop identified seven types of measures to address the issue of unsustainability, namely, rights, transparent and participatory management, support to science, planning and enforcement, benefit distribution, integrated policy, precautionary approach, capacity building and public awareness raising and market incentives.

This section examines how the identified “paths to solution” listed above could help to overcome the difficulties and obstacles to successful implementation of fishery management.

4.1 Rights

The granting of secure rights to resource users for use of portion of the catch, space, or relevant aspects of the fishery would certainly be an incentive for rights owners to use responsible fishing practices and to comply with management measures. The difficulty would be to select the appropriate criteria to determine who would be entitled to apply for such rights and who would not. In the context of developing countries, such approach may be difficult to achieve, especially where no economic alternatives to fishing is available.

The granting of secure rights to qualified fish farmers for the use of water and space, both on land and at sea, are crucial for the development of aquaculture.

There is a need to improve legal protection of fishers in many developing countries. This can be done through the clarification of their social and legal status and through the devising of specific sets of rules governing working conditions of fishers on board fishing vessels both in the industrial and small-scale fishing sectors (e.g. conditions of employment).

4.2 Transparent, participatory management

There is an urgent need to ensure transparency in decision-making processes through the establishment of appropriate mechanisms and procedures and to provide for meaningful participation of stakeholders in the full range of management. In small-scale fisheries, for instance, where surveillance is complex and virtually inexistent in most developing countries, involvement of fishing communities and local and traditional authorities in the monitoring and controlling of landing sites through the devising of appropriate mechanisms is critical to improve fishery management. Such steps would also be instrumental in restoring confidence in the government.

To avoid arbitrariness in decision-making processes, proper safeguards should be provided for in legislation (e.g. obligation to motivate decision where a right is denied, incorporation of appeal procedures, and restriction of discretionary power).

4.3 Support – science, enforcement, planning

While providing the resources necessary for all aspects of fishery management is certainly desirable, it is, as of yet, a wishful thinking in the context of developing countries. Therefore, effort to use more rationally whatever resources are available and to find ways to increase or secure financial support should be pursued. Particular effort should be directed at ensuring the long-term sustainability of programs started with the help of foreign aid and expertise (e.g. data collection system, MCS programs).

4.4 Benefit distribution

There is little doubt that unless socio-economic issues in coastal areas are addressed comprehensively by governments, plans of reduction of fishing capacity in over-fished coastal areas are unlikely to be successful. Therefore, economic tools to distribute benefits from the fishery could be used to tackle these problems. Adoption of such an approach, however, is likely to depend on the ability of the Fisheries Department to convince the government of the necessity of taking such a course of action.

4.5 Integrated policy

There exists a large consensus in the need to develop and apply an integrated policy if fishery management is to be effective. To do so, proper coordinating mechanisms between sectorial institutions would have to be devised as lack of cooperation is likely to be one of the main constraints to the achievement of this goal in developing countries.

4.6 Precautionary approach

Application of a precautionary approach in fisheries management is inscribed in most recent fisheries legislation. So far, however, few governments seem to have devised a strategy for its application. Failure to do so has led many governments to refuse to take action to reduce fishing capacity arguing that there is no sufficient scientific evidence to support that view. This shows that much effort remains to be done to ensure proper understanding and therefore proper application of the precautionary approach.

4.7 Capacity building and public awareness building

Capacity building is a central issue to help developing countries manage their resources effectively and has been rightly recognized as such by the international community as its inclusion in most development projects indicates. It is required in all aspects of management. Attention should also be given to the need to support the action of the judiciary as it is necessary to restore trust in the judicial system if judicial review is to be perceived as a deterrent.

Large dissemination of information to increase awareness of policymakers, lawmakers, enforcement officers and the public at large about main fisheries issues is required if the importance of what is at stake through fishery management is to be widely understood. Increased awareness and better understanding of fisheries issues by stakeholders will in turn improve the quality of their participation in the decision-making process and make it more meaningful.

4.8 Market incentives

In developing countries, effective use of market tools to improve responsible fishing requires that producers and the public at large be better informed about main fisheries issues.

5. CONCLUSIONS

So far, developing States have had little success in implementing international fishery instruments effectively. Lack of political will plays an important role in governments' inability to discharge their responsibilities under international fishery instruments as few of them have devised any strategy for their implementation.

While, as shown above, an array of factors contribute to ineffective fisheries management, the main constraint appears to be that of bad governance. Bad governance affects all dimensions of fisheries management. Of particular importance is the failure of governments to provide for adequate mechanisms and procedures in decision-making processes (to ensure transparency and fairness) and in coordinating of actions between different entities at the various levels of government. Although progress has been made to ensure participation of stakeholders in fisheries management through the establishment of fisheries management committees or other institutional arrangements, more effort remains to be made to ensure the proper functioning and the long-term sustainability of such mechanisms. For a long time, governments have primarily directed their actions at industrial fisheries, while little attention has been paid to small-scale fishers. Where it has, it generally responds to a need to maintain peace in coastal communities, but rarely translates a willingness to improve their economic and social conditions. Another result of bad governance is the general distrust in the judicial system displayed by people in many developing countries. This, of course, should be a matter of primary concern as it reflects States' inability to enforce the rule of law.

Steps towards sustainability should therefore primarily focus on the need to improve governance through capacity building, awareness raising and strengthening of the rule of law.

PART III

NOTES PREPARED BY PARTICIPANTS

1. **COMPLIANCE WITH INTERNATIONAL FISHERIES LAW**
   by Annick Van Houtte

2. **SOME IDEAS RELATING TO FISHERY SUSTAINABILITY**
   by Anthony Charles

3. **OVERVIEW OF PRAWN AND NILE PERCH (*LATES NILOTICUS*) FISHERIES AND SUSTAINABILITY IN TANZANIA**
   by T.W. Maembe

4. **ECUADORIAN FISHERIES**
   by Raphael Trujillo

COMPLIANCE WITH INTERNATIONAL FISHERIES LAW

by

Annick Van Houtte[119]

Sustainable development:
"...development that meets the needs of the present without compromising the ability of future generations to meet their own needs..."

Summary

We are faced with a rapidly growing wealth of international instruments which govern the utilization and conservation of marine living resources and the management of the marine environment. The core of international fisheries instruments have developed over a period of several hundred years. For the purposes of the Bangkok Workshop,[120] Michael Lodge prepared a paper entitled "Review of Factors of Unsustainability in Fisheries: Relationship to International Fisheries Instruments". In this document he made an attempt to identify whether the main factors contributing to unsustainability in fisheries[121] are addressed in international fisheries instruments. In line with the paper and with the Workshop discussion, there was a general consensus that the international fishery instruments in existence address directly or indirectly many of the factors contributing to unsustainability in fisheries today. It was also generally acknowledged that the instruments require actions to be taken at global, regional and national level. The issue in question is one of implementation and compliance.[122] This paper attempts to look into the issue by looking briefly into the elements which prompted the development of international fisheries law over the last 50 years, the nature of those rules or forms of commitments and by touching upon a few impacts they had at global and regional level. It is hoped also that this will allow a timely reflection on whether the legal framework for fisheries governance needs to be improved.

1. HISTORY: WHAT ELEMENTS PROMPTED THE DEVELOPMENT OF INTERNATIONAL FISHERIES LAW OVER THE LAST YEARS?

1.1 Towards the 1982 UN Convention

The basis of the legal framework for ocean governance, in particular fisheries governance, lays in the 1982 UN Convention of the Law of the Sea ("the 1982 UN Convention")[123]. It may be asked what elements prompted the development of the rules over the last 50 years.

It goes without saying that the prevailing factor in the law making process was the economic interests of States. In addition the fishing industry is (and has always been) a market driven and increasingly dynamic internationalized sector.

In the early nineties, it became obvious that the old regime of "open seas" (*"mare liberum"*) developed by Hugo Grotius which dominated the approach to fisheries resources for the last 400 years was no more meeting the needs of the States. It was during and at the close of the Second World War that developments of new technologies began to require a corresponding development of new law. In 1946, the two Proclamations of President Truman of the United States focused attention on two basic problems: the conservation of stocks in the then so-called high seas, and the exploration and exploitation of the resources of the seabed and subsoil of the continental shelf under the high seas. Both Proclamations foreshadowed solutions by extending, out into the area of the high seas the national jurisdiction of the coastal state. The First and Second United Nations Conferences on the Law of the Sea (UNCLOS I and II) constituted the first efforts to codify the international law of the sea and to create a harmonized system of ocean governance. From then on, the rapid development of science and technology, the economic interests, the security concerns and the escalation of claims of extended jurisdiction prompted States to take unilateral actions with regard to limitations of jurisdiction.

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[119] The views expressed in this paper are solely those of the author, Annick Van Houtte, Legal Officer, FAO.

[120] FAO Workshop on Factors of Unsustainability and Overexploitation in Fisheries held in Bangkok in February 2002.

[121] Key factors had been identified in the discussion paper prepared for FAO by Stephen Cunningham and Jean-Jacques Maguire. See publication D. Gréboval, Report and documentation of the International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries, FAO/Japan Government Cooperative Programme GCP/INT/788/JPN, Rome, 2002.

[122] "Compliance" is to be understood in this context the factual matching of State behaviour and the international rule.

[123] Hereinafter the 1982 UN Convention, entered into force on 16 November 1994.

It was against this background that the UNCLOS III started in 1973, the outcome of which was in the 1982 UN Convention. That the Conference in itself lasted so long is not surprising and is to be related to the on-going State practices during the negotiations. The 1982 UN Convention was the only way to rationalise the competing claims in a manner that would address the:

- potential conflicts among States and between States;
- competing uses of the ocean; and
- impact of these activities on the marine environment.

While the 1982 UN Convention was still negotiated and until the Rio Conference on Environment and Development in 1992 a number of other instruments, regulatory and technical instruments related to ocean governance, covering/impacting on fisheries resources were established through global and regional organizations.

Regional developments took place driven by the need for conservation of marine living resources and, if possible, for development of fish stocks and for fairer distribution of yields, by good and informed management. To list a few, these include the:

- 1976 Convention for Fishing in the North Atlantic;
- 1973 Convention on Fishing and Conservation of the Living Resources of the Baltic Sea and the Belts;[124]
- 1979 South Pacific Forum Fisheries Agency Convention;[125]
- 1966 International Convention for the Conservation of Atlantic Tuna;[126]
- 1949 Agreement for the Establishment of the General Council for the Mediterranean;[127]
- 1980 Convention on Future Multilateral Cooperation in Northeast Atlantic Fisheries.[128]

Rules for ocean governance going beyond the 1982 UN Convention developed under many instruments and under the auspices of global and regional organizations. Among these must be included those instruments which deal *inter alia* with the following issues:

- prevention of pollution of the sea: the rules and guidelines of the International Maritime Organization in relation to maritime safety and prevention of pollution from ships; the Dumping Convention of 1972;

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[124] Entry into force: 27 July 1974 and Protocol, 11 November 1982, which entered into force: 10 February 1984, see http://www.ibsfc.org/.

[125] Entered into force: 9 August 1979, see http://www.oceanlaw.net/texts/ffa.htm.

[126] see http://www.iccat.es.

[127] see http://www.fao.org/fi/body.asp#gfcm.

[128] Entered into force on 17 March 1982.

- protection of the coastal habitats and areas: the Regional Seas Programme inaugurated in 1974, which is based on a periodic revision of action plans adopted by high-level intergovernmental meetings; the Paris Convention of 1972; the RAMSAR Convention of 1971;

- regulation of particular area and/or particular resources: the Antarctic Treaty Regime; the regulation of whaling; the Protocol of Geneva of 1982 concerning the special protected areas in the Mediterranean.

All instruments make an important contribution to the overall system of ocean governance.

Meanwhile catch effort and capacity continued to increase beyond levels of available fish, coastal states tended to protect stocks off their coasts for food security, income generating and employment purposes. Coastal States wanted their special interests in the protection of the resources recognized. Obviously, in contrast, distant-water fishing states were seeking protection of their access rights to high seas resources. The world became conscious that "the problem of the ocean space were closely interrelated and need to be considered as a whole"[129]

The 1992 United Nations Conference on Environment and Development

As was the case with the United Nations Conference on the Human Environment, in 1972 in Stockholm, the first international meeting to address the issue of the environment, the United Nations Conference on Environment and Development held at Rio de Janeiro in 1992[130], through its expression of concern for the need to find a balance between the protection of natural environment, human well being and economic development, constituted a landmark and provided an impetus and a basis for the development of new instruments relating to ocean governance, and in particular more recently to fisheries governance.

The 1992 UN Conference considered a number of complex concepts such as intergenerational equity, sustainability, and precaution. Sustainability of fisheries resources is supported not merely to satisfy future needs of those currently living but for future generations as well. The underlying basic concept of Agenda 21 is that natural systems interact, that human activities are capable of undermining those systems with consequential damage to human well being. Rio's Declaration of Principles recognizes the Earth as having an "integral and interdependent nature".[131] Marine fisheries were addressed in the broad context of the wider natural environment.

The 1992 UN Conference adopted a Declaration of Principles[132] and a detailed Plan namely Agenda 21, under which Chapter 17 deals with ocean governance, including fisheries resources.[133] It stresses the need for approaches that are "precautionary and anticipatory in ambit" and emphasises specifically the relevance of precaution in the oceans environment.

The 1992 UN Conference and the adoption of Agenda 21 led to a number of institutional developments within the UN system:

- Commission on Sustainable Development of UN Economic and Social Council, mandated to review the implementation of Chapter 17 at international and national level;

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[129] Preamble of the 1982 UN Convention.

[130] UN Conference 1992.

[131] Preamble of the 1992 Rio Declaration.

[132] hereinafter the 1992 Rio Declaration.

[133] The Convention of Biological diversity (CBD) that was opened for signature at UNCED meeting crystallizes three concepts in its objectives summarized in article 3 of the Convention: the three objectives are conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits stemming from the utilization of genetic resources.

- Inter-Agency Committee on Sustainable Development (IACSD) under the ACC (Administrative Coordination Committee);
- Oceans and Coastal Areas Subcommittee on Sustainable development (SOCA) under the IACSD; and
- the Open-Ended Informal Consultative Process established by the UNGA (resolution 54/33) in order to facilitate the annual review by the Assembly of the development in oceans affairs.

1.2 Developments in international fisheries law since the 1992 UN Conference

A number of new legal instruments that affect international governance of marine fisheries have been developed and adopted since the 1992 UN Conference, incorporating basic principles and concepts expressed in the Rio Declaration and Agenda 21, Chapter 17.

Indeed, international law makes a distinction between "hard law" and "soft law" instruments. Both are products of careful negotiation but while the former are binding among the State parties the latter is not. However the latter is often the reflection of an emerging consensus and an emerging principle which may result in a binding instrument or customary international law. Some think also that soft law may constitute a basis for interpretation of hard law instruments.[134]

Michael Lodge in the paper which he prepared for the Bangkok Workshop 2001,[135] has examined several of those post 1992 UN Conference instruments against the factors of unsustainability.

Hard law developments include the:

- FAO Agreement Compliance;[136]
- UN Fish Stocks Agreement;[137]
- New regional agreements emerge, such as the so called Galapagos Agreement,[138] Convention on the Conservation and Management of the Fishery Resources in the South-East Atlantic Ocean[139] and the Convention on The Conservation and Management of Highly Migratory Fish Stocks in The Western and Central Pacific.[140]

Soft law instruments include:

- 1995 FAO Code of Conduct for responsible Fisheries;[141]
- Jakarta Mandate developed by parties to Convention on Biological Diversity;[142]

- International Plans of Action covering the following subject matters:

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[134] W.R. Edeson, "Closing the gap: The Role of "soft" international instruments to control fishing (1999) 20 Aust YBIL, p.83. See also P. Birnie , "New approaches to Ensuring Compliance at Sea: The FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas", 8 Review of European Community and International Environmental Law 48-55 (1999).

[135] See page 1 above.

[136] The FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, 1993.

[137] Agreement For The Implementation Of The Provisions Of The United Nations Convention On The Law Of The Sea Of 10 December 1982 Relating To The Conservation And Management Of Straddling Fish Stocks And Highly Migratory Fish Stocks, 1995.

[138] the Framework Agreement for the Conservation of Living Marine Resources of the South Pacific, adopted on August 14, 2000. See www.oceanlaw.net/texts/galapagos.htm.

[139] The Convention on the Conservation and Management of the Fishery Resources in the South-East Atlantic Ocean setting up the South East Atlantic Fisheries Organization, adopted in April 2001. See www.oceanlaw.net/texts/seafo.htm.

[140] Adopted in Honolulu in September 2000.

[141] Hereinafter the Code, adopted by the FAO Conference in October 1995.

[142] The Jakarta Mandate includes Recommendation I/8 (UNEP/CBD/COP/2/5 AND UNEP/CBD/JM/EXPERT/I/Inf.2 and Decision II/10 of the Second Meeting of the Conference of Parties to the Convention (UNEP/CBD/COP/2/19 and UNEP/CBD/JM/EXPERT/I/Inf.3).

- Management of Fishing Capacity;[143]
- Conservation and Management of Sharks;[144]
- Reduction of Incidental Catch of Seabirds in Longline Fisheries;[145]
- Illegal, Unreported and Unregulated Fishing (IUU fishing).[146]

In the area of our concern, the soft law instruments contribute to the evolving regime for world fisheries. The Code must be viewed as fruit of an international consensus and as a tool, a framework for dealing with fisheries problems worldwide. While the contents of the Code were being negotiated, the contents of the 1995 FAO Compliance and the UN Fish Stocks Agreements were being also respectively defined. The discussion around the Code helped in particular in the adoption of the latter agreement.

The Code has affected and will continue to affect the work of regional fisheries bodies, existing ones and newly emerging ones. The Code gains increasing support at national and local level. The response of the international community to concerns of overfishing, depleted stocks, irresponsible fishing practices shows the impact of non binding instruments and some rules it contains.

Implementation of these instruments should have a considerable impact on sustainability of fisheries resources. All depend on how they are being executed. Among these instruments some are more proactive and maybe practical, in other words more likely to influence behaviour of States. International attempts are made to address compliance related issues. Most instruments call primarily for actions by States but also by regional fisheries bodies. It may thus not be forgotten that the final outcome will depend on how provisions and plans are being executed because after all institutions are not ends in themselves but necessary instruments largely in the hands of States to perform specific duties.

The IPOA on IUU fishing and UN Fish Stocks Agreement may very briefly illustrate some of the above aspects.

The UN Fish Stocks Agreement represents an effort in the progressive development of international law on fisheries: it facilitates implementation of certain provisions of the 1982 UN Convention, it strengthens certain provisions. With respect to enforcement and in the light of the focus on the role of regional fisheries bodies, it should be noted that specific enforcement related roles are provided to port States and to States party to a regional agreement in addition to flag States to the extent that the concept of exclusive jurisdiction over vessels flying State's flag on the high seas is being slowly eroded. The Agreement has entered into force but key high seas fishing States have not ratified or acceded to the Agreement. One may recall that the Convention on Fishing and Conservation of the Living Resources of the High Seas, Geneva 1958, which sought to create duties for fishing nations to cooperate with respect to fishing on the then called high seas, also entered into force but obtained only some degree of support and was not widely implemented. Notably it was not ratified by at the time important fishing nations.

The IPOA on IUU fishing contemplates a number of different problem areas, identifying roles for flag States, coastal States and port States and increasing awareness of the need for effective monitoring, control and surveillance of fishing activities from catch to landing and final destination.[147] While the flag State responsibility is emphasized, as well the role of regional fisheries bodies in monitoring control and surveillance through observer schemes, port State responsibilities have been outlined. Port States are viewed as important participants in the collective effort to combat IUU fishing. It appears to have the capacity to collect relevant information and to conduct inspection of foreign fishing vessels entering its ports. Port States may channel information on IUU activities of a foreign fishing vessel to its flag State, eventually a coastal State and a regional fishing body. Port States can provide an alternative source of sanctions in situation where a flag State is unwilling or unable to act. A link is finally made between trade and IUU fishing as a call is made for limiting market opportunities for IUU fish. Several developments are taking place to implement this action plan, at national and regional level. For instance decisions are being adopted by regional fisheries bodies to implement elements of the Plan.

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[143] adopted in 1999, see www.fao.org/fi/ipa/capaci.asp.

[144] adopted in 1999, see www.fao.org/fi/ipa/manage.asp.

[145] adopted in 1999, see www.fao.org/fi/ipa/incide.asp.

[146] adopted in 2001, see www.fao.org/fi/ipa/iuu.asp.

[147] FAO, "New International Plan of Action Targets Illegal, Unregulated and Unreported Fishing" Press Release 01/111 online www.fao.org/waicent/PRESS_NE/PRESSENG/2001/pren0111.htm.

There are for instance some global attempts to address the issue of Flag of Convenience vessels in relation to IUU fishing by strengthening the flag State obligations. New avenues are explored in order to deal with this challenge. CCAMLR (Convention on the Conservation of Antarctic Marine Living Resources) in 2002 has implemented the concept whereby States notorious for having flagged vessels engaged in IUU fishing should be identified, as it is "convenient" to use some specific flags to avoid being bound by conservation and management measures. A new terminology of "Flag of Non-Compliance" (FONC) has been introduced. It implies that Contracting Parties and non-Contracting Parties cooperating with CCAMLR should prohibit landings and transhipments of fish and fish products from FONC-vessels.[148] Some RFOs[149] and States (e.g. Canada) already operate lists of vessels regarded as being IUU-vessels.[150]

It may be asked whether the implementation of the Plan will be more successful than of the UN Fish Stocks Agreement. This shows that implementation and compliance of an international instrument is not always a matter of a binding or not binding instrument, or of accession or ratification. It may be a simple matter of concerns or of different interpretation of concepts. The issue relating to the potential development of preferential rights of coastal States in case of straddling fish stocks or highly migratory fish stocks is of concern for those fishing nations most actively participating in high seas fishing. It is highly likely that this is one of the reasons why many of them have not ratified the UN Fish Stocks Agreement.

The impact of a concern may also be illustrated when looking into the compliance to the General Assembly Ban on Driftnet Fishing[151] which originated following the particular concerns of a few group of States despite uncertainties surrounding the true environmental impact of driftnet fishing and the few areas where driftnet fishing extensively occurred. Some factors have contributed to its success: concerns arose at the time the concept of "sustainable development" was becoming influential, the United Nations monitored continuously the implementation of the ban with the assistance of States, through reports of other international organizations and NGOs; the regional initiatives (the Wellington Convention, 1989)[152] which preceded the adoption of the resolutions, the prominent role played by the United States to enforce the resolutions, the EU responses[153], and finally the various progressively positive driftnet fishing States responses.[154]

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[148] See Resolution 19/XXI.

[149] IOTC (Indian Ocean Tuna Commission) has agreed on a resolution calling upon the parties to refuse port access to "flag of convenience vessels, which are engaged in fishing activities diminishing the effectiveness of measures adopted by IOTC" (IOTC Resolution 99/02 calling for Action Against Fishing Activities by Large-Scale Flag of Convenience Longline Vessels); it also adopted a resolution to establish a list of vessels presumed to have carried out IUU fishing in the IOTC Area (Resolution 02/05 was adopted on "Establishing a List of Vessels Presumed to Have Carried Out Illegal, Unregulated and Unreported Fishing in the IOTC Area"), ICCAT (International Commission for the Conservation of Atlantic Tunas) has adopted the concept of listing specific IUU States by agreeing on a measure identifying States whose vessels have been fishing for tuna and tuna-like species in a manner which diminishes the effectiveness of ICCAT conservation and management measures.

[150] It should also be mentioned that for example Canada grants access to its waters and ports only to fishing vessels from a State with which Canada has favourable fishery relations. The listed States are those that consistently co-operate with Canada on international fisheries conservation objectives, including sound conservation and management of fish stocks off the coasts of Canada.

[151] UNGA Resolutions 44/225, 1989 and 46/215, 1991.

[152] Entered into force in 1991.

[153] Regulation No 3094/86. However, there was a lot of resistance from the Italian Government.

[154] For further reading, see Donald R. Rothwell, "The General Assembly Ban on Driftnet Fishing", in Commitment and Compliance, edited by Dinah Shelton, Oxford University press, 2000.

Yet the absence of consensus on a concept may also delay effective and harmonized implementation. It is sufficient to observe the evolution of the "acceptance" of the "precautionary principle" or even "precautionary approach". While the principle seems to be recognized, there is still disagreement on how this principle should be defined and how it should be applied to the wide variety of situations. Some argue that it is hard to establish a universally applicable definition that is more meaningful or useful than "take care" or "better safe than sorry".[155] Some States seem more comfortable referring to a "precautionary approach" rather than a "precautionary principle" hoping that this term will allow more flexibility.[156] Both the UN Fish Stocks and the Code of Conduct for Responsible Fisheries elaborate on the precautionary approach. The Code invites to a wide application of the approach to conservation, management and exploitation of fishery resources and provides that the absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures.[157] As a general principle, coastal States and States fishing on the high seas have a duty to apply the precautionary approach in order to conserve and manage straddling fish stocks and highly migratory fish stocks under UN Fish Stocks Agreement. The approach is further explained in Article 6 of the Agreement. Both instruments address target and limit reference points and indicate that the approach of maximum sustainable yield alone is not sufficient to avoid overexploitation. There is a need to consider a wide range of factors which go beyond the fish stock and the fishing activity. In contrast, the Appellate Body of the World Trade Organization has a more cautious interpretation of the precautionary principle and still seems to question whether the principle has crystallized into a general principle of customary international law.[158]

This shows that the repetition of a concept in various instruments or judicial fora can give or not give rise to, and express eventually the "*opinion juris*" of the international community.

1.3 The World Summit on Sustainable Development: salient features

The World Summit on Sustainable Development in Johannesburg, South Africa from 2-4 September 2002 (WSSD) reflects and strengthens the concepts found 1992 Rio Declaration of Principles and reaffirms the commitment to sustainable development. Johannesburg WSSD gives an additional impetus to the concept of sustainable development by addressing the problem of poverty. While the global environment continues to suffer, poverty eradication is considered an "essential requirement for sustainable development".[159]A strong link is made between poverty, the environment and the use of natural resources.

It moves further from a reactive mode to a proactive mode to attain sustainable development: governments agreed on a wide range of concrete commitments and targets for action within a timeframe, supported the establishment of a world solidarity fund for the eradication of poverty, paid special attention to the development needs of Africa and in the key role that partnerships initiatives, such as the new Partnership for Africa's Development (NEPAD) can play in achieving the objectives of sustainable development.

Under the Johannesburg Plan of Implementation,[160] oceans and fisheries are considered primarily under the general chapeau of "Chapter IV on the Management of the Natural Resource Base". After reaffirming that "oceans, seas, islands and coastal areas form an integrated and essential component of the Earth's ecosystem and are critical for global food security", Chapter IV (paragraphs 30 etc.) calls firstly upon effective coordination and cooperation and actions at all levels i.e. national, regional and international, to ensure sustainable development of the oceans. States are invited to ratify or accede to and implement the 1982 UN Convention[161]. Cooperation and coordination should aim at: promoting the implementation of chapter 17 of Agenda 21, establishing an effective, transparent and regular inter-agency coordination mechanism on ocean and coastal issues within the UN system, encouraging the application by 2010 of the ecosystem approach, promoting integrated coastal and ocean management at national level, to strengthening cooperation between regional organization and programmes, assisting developing countries in coordinating policies and programmes at regional and sub-regional level aimed at sustainable fisheries development and implementing coastal area management plans.

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[155] Frank Cross, Paradoxical Perils of the Precautionary Principle, 53 Wash. &Lee L. Rev. 851, 1996.

[156] See Ellen Hey, The Precautionary Concept in Environmental Policy and Law: Institutionalizing Caution, 4 Geo. International Environmental Law Revue 303,304 (1992).

[157] Code, paragraph 7.5.1.

[158] In the case of EC Measures Concerning meat and meat Products (Hormones), 1997.

[159] The Johannesburg Declaration on Sustainable Development, principles 11 & 13.

[160] The full text is available on the official website: www.johannesburgsummit.org.

In a second instance[162] the Chapter deals with actions required at all levels to achieve sustainable fisheries resources. On an urgent basis and where possible by 2015, depleted fish stocks should be maintained restored to levels that can produce maximum sustainable yield. A general invitation is made to ratify or accede to relevant and, where appropriate, associated regional fisheries agreements or arrangements. While drawing the attention to the special needs of developing countries, an impetus is given towards enhancing the implementation of the FAO Code of Conduct, its Technical Guidelines and its IPOAs. The putting into effect of the IPOA on IUU by 2004 and the IPOA for the Management of Fishing Capacity by 2005 is particularly urged. A number of special issues are addressed, including the need for the development of effective monitoring, reporting and enforcement, for control of fishing vessels, "including by flag states". Furthermore, regional fisheries management organizations and arrangements should pay particular attention to the duties, rights and interest of coastal states, and the special requirements of developing states when dealing with allocation patterns for straddling and highly migratory fish stocks. A general call is made to eliminate subsidies, especially those contributing to IUU fishing and over-capacity. Finally there is a general recognition of the need for sustainable aquaculture development in the light of its increasing contribution to food security and economic development. It may be asked what the impact will be of this paragraph 31 of the Johannesburg Implementation Plan.

Thirdly the promotion and management of oceans in general are considered dealing with several aspects in a piecemeal manner.[163] There is the general recognition expressed of the need including for:

- actions at all levels giving due regard to relevant international instruments;
- maintenance, productivity and biodiversity of important marine and coastal areas, within and beyond national jurisdiction. Particular reference is made to the work programme arising from the Jakarta Mandate;[164]
- development of the use of divers approaches and tools, including the ecosystem approach to preserve marine and coastal ecosystems, including rare of fragile ecosystems, such as reefs;
- implementation of the Ramsar Convention, of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities; and
- development of partnership, scientific research, diffusion of technical knowledge.

A fourth paragraph under this Chapter IV is dedicated to the enhancement of maritime safety and protection of the marine environment from pollution by actions at all levels.

The need for improving the scientific understanding and assessment of marine and coastal ecosystems (living and non-living resources) as a fundamental basis for sound decision-making is also emphasized. To address this need, by 2004 of a global reporting and assessment of the state of the marine environment should be established. Emphasis is also put on the need for capacity-building activities including at national and local levels in marine science and the sustainable management of oceans and their resources.

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[161] The 1982 UN Convention

[162] Plan of Implementation of the WSSD, Paragraph 31.

[163] Id. Paragraph, 32

[164] In accordance with article 23 of the Convention Biological Diversity, a Conference of parties (COP) was established for periodic meetings to review and implement the convention. At its second meeting in Jakarta in November 1995, the parties adopted a program of action in regard to marine and coastal biodiversity, known as the "Jakarta Mandate". There were recommendations relating to five thematic areas: integrated marine and coastal area management, mariculture, alien species, living marine resources and marine protected areas. On this Mandate see: "A User Friendly Guide to the Jakarta Mandate on Marine and Coastal Biodiversity", online at www.igc.apc.org/bionet/jakarta.html.

To summarize, the Johannesburg Plan:

- focuses primarily of the "ocean" and emphasizes the importance of addressing sustainable development of oceans, including sustainable fisheries;
- reaffirms that the 1982 UN Convention is the "constitution for ocean governance" and emphasizes its unified character. Contrary to what happened under Agenda 21, Chapter 17, no particular distinction is made between living resources of the high seas and those under national jurisdiction - the two are not addressed in distinct sections – and particular issues receiving attention are over-capacity and IUU fishing;
- the conservation of living and non-living resources of the oceans are taken into consideration;
- a call is made for actions and initiatives at all levels, but in particular at regional and sub-regional levels as well as at national level (improving national management and enforcement activities) to further the principles laid down in Agenda 21, Chapter 21.

2. SOME CONCLUSIONS

Where should/will we be going from here? International and national governance of fisheries is in the middle of a change: it moves from a traditional freedom of seas towards ... a more purposeful managed system.

The 1982 UN Convention remains the basic instrument for fisheries governance but may require future elaboration in the light of contemporary events and needs.

The most recent instruments appear to suggest that focus in the near future with respect to fisheries will be set on:

- strengthening flag state jurisdiction, and responsibilities of port states and coastal states;
- use of trade related measures to ensure compliance and commitment;
- strengthening existing regional fisheries bodies and creating new ones where needed;
- increasing the use of the precautionary approach into proactive fisheries management, accompanied with an strong recognition of the need for scientific understanding of fisheries and fisheries ecology;
- implementing eco-system based approaches to management of living resources from sectoral to more holistic approaches at national and international level.

There is no recipe for success that will ensure implementation of international instruments and there is still an important discrepancy between commitments and action, in other words there is a concern about the willingness of States to accept and act upon instruments.

Both soft law and hard law instruments attract compliance by targeted members of the international community at different rates however. It may be asked whether differences between compliance with soft law or hard law instruments are expected by those concerned. While from a strictly legal point of view, although the lack of a binding form may reduce the options for enforcement in the short term (i.e. no litigation), one may not deny that factors that influence compliance seem to overlap: such factors include the environment in which the rules are created and operate, the relationship between the rules and the practices it is to order, the transparency of the rule (e.g. the clarity of the obligation), the degree of support for the rule among affected members (including how free riders problems could be addressed), degree of political and economic support, the legitimacy of the process by which the rule was created, the capability (structural and economic capabilities) of the objects of the rule to conform to it, the foreseeable consequences of non compliance, including sanctions. Not all the factors will be relevant nor will all the rules be equally influenced by all these factors.

Furthermore, it should be noted that to further ensure compliance political, economic and other pressures can be equally exercised on those who tend to ignore the rules whether these are embodied in a hard or soft law instrument. Needless to add that legal remedies (e.g. third party dispute settlement) are rather avoided in favour of "non legal" remedies (e.g. negotiation).

Both non binding and binding text can suggest the adoption of necessary legislation at national level.

Finally States retain the ultimate control over the level of commitment attached to an international instrument and this may affect the level of compliance to such instrument too.

SOME IDEAS RELATING TO FISHERY SUSTAINABILITY

by

Anthony Charles[165]

Summary

This brief 'paper' is not so much a paper *per se* but rather an annotated collection of eight ideas that this author has found useful in thinking about factors of unsustainability in fisheries, and paths to sustainable solutions. More details on the material here may be found in Charles (2001).

Resilience

Discussions of sustainability are being increasingly linked with the concept of resilience. The idea of resilience was first introduced to describe the capability of ecosystems to absorb unexpected shocks and perturbations (whether due to natural or human actions) and 'bounce back', without collapsing, self-destructing or otherwise entering an intrinsically undesirable state. As Holling (1973, p.17) wrote: "*Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables and parameters, and still persist.*" The concept of resilience applies beyond ecosystems, implying that not only the relevant ecosystem, but also the human and management systems are able to absorb shocks, such that the system as a whole sustains (on average) a reasonable flow of benefits over time. Thus the various components of sustainability have resilience counterparts, which must equally be taken into account. In a fishery, we can envision resilient fishing communities, a resilient economic structure in the fishery, a resilient ecosystem in which the fish live, and resilient management institutions. A key issue, then, is: What policies and management approaches contribute both to sustainability and to resilience in fisheries? For example, Folke and Berkes (1995, p.132) argue that to build resilience into institutions, "*The task is to make institutional arrangements more diverse, not less so; to make natural system – social system interactions more responsive to feedbacks; and to make management systems more flexible and accommodating of environmental perturbations*".

Attitudes

Unsustainability in fisheries has been blamed on a wide range of factors, including over-fishing predators, cold water, destructive gear, government management, stock assessments problems, and politics. But underlying much of this, a common thread appears: the prevailing *attitudes* in the fishery - attitudes about nature, about management, and about how the fishery should function. Attitudes are popularly viewed as something *personal* (for example, whether or not there is a 'conservation ethic' among fishers), but in fact attitudes arise equally importantly at an *institutional* level (e.g., in fishery science, in the design of management measures, in industry, and in fishery organizations) – where they have the greatest impact on fishery decision making. Such attitudes may have been driving forces in unsustainable fisheries. Charles (1995) discusses some of these attitudes, under the headings: 'burden of proof' (application of the Precautionary Approach), 'conservation can wait' (use of built-in processes that delay conservation actions), and 'the system works' (a belief in the fundamental validity of the fishery management system). Related to these are the *Illusion of certainty* and the *Fallacy of controllability*, discussed below.

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Illusion of Certainty

While the great uncertainties inherent in fisheries are well documented, some management systems exhibit a tendency to ignore major elements of uncertainty, so that far from recognizing and working within the bounds of this uncertainty, management may create an 'illusion of certainty' that leads to the opposite result. Suppose, for example, that in quota management, we set a TAC, sub-divide it among sectors or fishers, and treat the resulting allocations as fixed within the fishing season. This process may suffer from an illusion of certainty, in that an impression is created of the TAC as a well-established 'pie' that can be cut into several precisely-determined shares, and that is sacrosanct, with fishers literally 'banking' on these shares. This perspective, downplaying inherent uncertainties in the fishery, has led to conservation problems in the past. In contrast, an approach of 'living with uncertainty' might involve adaptive management approaches, in which fishing plans, and individual 'fishery business plans', are designed to adjust to unexpected changes in the natural world.

Fallacity of Controllability

Fisheries can be only partially, and imperfectly, controlled. Unfortunately, this reality is by no means universally recognized - a 'fallacy of controllability' is often in place, reflecting a sense that more can be known, and more controlled, in fisheries than can be realistically expected. For example, successful quota management requires an ability to enforce the quota, and an ability to prevent dumping of fish that may lead to discrepancies between landings and catches, among other things. However it is not uncommon to implement a TAC without having satisfied these preconditions. The resulting lack of control the manager has over the actions of fishers and, by extension, over the quality of fishery data collected, may lead to unsustainability. Overcoming the fallacy of controllability leads us to focus on the challenge of developing management measures to optimize overall sustainability of inherently uncontrollable fisheries.

Robust Management

In a world where the limitations on what is possible through fishery management are beginning to emerge clearly, one ingredient in moving toward sustainability and resilience lies in pursuing *robust management* – providing 'reasonable' success in meeting society's objectives, even if (a) our current understanding of the fishery (notably the status of the resources), its environment and the processes of change, turns out to be incorrect, and/or (b) the actual capability to control fishing activity is highly imperfect. In other words, a *robust* management system is one in which obtaining reasonable performance from the fishery (i.e., an acceptable level of success) does not depend on perfect knowledge of the structure and dynamics of the system, nor of all variables. Clearly this is not easy to achieve: moving toward robust management would seem to require more than minor changes – indeed, a re-thinking of the philosophy of management, and a re-assessment of current management approaches.

Management Portfolios

A wide array of management measures is available in fisheries, each with its advantages and disadvantages. An over-emphasis on any single measure is unlikely to lead to sustainability and resilience, as there will always be some situation in which any such method fails – whether dumping and highgrading with quota management, an inability to control enough fishery inputs with effort management, or excessive exploitation on unprotected parts of the stock (or distinct sub-stocks) with closed seasons and closed areas. The point is that any single management measure cannot be considered 'safe'. A portfolio (set) of mutually-reinforcing management tools is needed, selected on a case-by-case basis, taking into account society's objectives, biological aspects of the resource, human aspects such as tradition and experience, the level of uncertainty and complexity in the fishery and the predicted consequences of the various instruments.

Efficiency

Misinterpretations of the idea of efficiency can lead to policy decisions that fail to properly balance the various components of sustainability. A proper view of efficient policies are those that 'do the most with what we have' – those that best meet society's objectives given the existing constraints. Hence, the pursuit of efficiency is desirable, by definition. However, pursuit of efficiency is meaningless, and potentially misguided, without clearly defining what objectives we are pursuing. In particular, it is sometimes thought that efficiency means generating the most profits (or rents), but this is *not* the case *unless* the fishery has no other goals (e.g., employment, community health, safety, etc.). In other words, it is only when we decide the balance among the many fishery objectives that we can properly refer to what makes an 'efficient' fishery. Without this, claims of greater 'efficiency' for one policy over another may merely reflect the personal preferences of those advocating the policy.

Economic/Livelihood Diversification

Economist Ian Smith (1981: p.22) pointed out long ago that often fishery management programs "*fail to deal adequately with fishermen who are displaced*" and that accordingly policies to deal with over-exploitation and over-capacity by reducing the number of fishers may well aggravate the fishery problem. The challenge of livelihood diversification is by no means simple, yet efforts in this direction seem critical to the success of programs for sustainable fisheries. Such efforts will typically be composed of within-fishery and non-fishery actions. First, within the fishery, it can be useful to encourage multi-species fishing, in which each fisher utilizes a range of fish resources, in contrast to policies that lead to specialization in single-species fisheries. By diversifying across sources of fish, the individual fisher reduces risks, and the collective pressure to over-exploit may also be reduced. Second, looking beyond the fishery *per se*, it can be useful to encourage multiple sources of livelihood for fishers (with fishers holding a range of jobs in addition to fishing). This is common as a traditional practice in many seasonal fisheries, and lets fishers avoid total reliance on fishing for their income, reducing the pressure they would otherwise face to obtain a livelihood entirely from the fishery, and thus reducing pressure on the fish stocks. Third, there is a need to diversify the coastal economy, by creating new, sustainable economic activity outside the fishery sector (e.g., fish farming, coastal tourism). This enhances the range of available livelihood choices and tends to increase income levels outside the fishery, so it is more attractive for fishers to leave the fishery, and incentives for others to enter are reduced.

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OVERVIEW OF PRAWN AND NILE PERCH (*LATES NILOTICUS*) FISHERIES SUSTAINABILITY IN TANZANIA

by

***T.W. Maembe*[166]**

Summary

The artisanal fishermen dominate the exploitation of fisheries resources in Tanzania. They catch more than 90 percent of fish both in freshwater and marine waters. However the fisheries resources are being threatened by increase of population, environmental degradation and poverty, among others. This paper addresses issues of un-sustainability and over-exploitation on the prawn and Nile perch fisheries resources of Tanzania.

1. BACKGROUND

Tanzania is surrounded by four major water bodies namely the Indian Ocean and the three great lakes of Africa which are Lakes Victoria, Tanganyika and Nyasa. The country has diverse river systems, numerous wetlands and other minor waters. The major and minor water bodies have made the country to have a significant production in both marine and freshwater fisheries resources.

The fisheries sector is a source of employment, income and food/protein, among others to millions of Tanzanians. The sector contributes around 2.8 to the National Gross Domestic Product (GDP) and over 12 per cent to foreign exchange earning. More than 80 000 fishermen are full time employed in the fisheries sector and a few millions derive their economic livelihood from the sector in one way or another in fisheries related activities. It is also a source of recreation, tourism and foreign exchange earnings.

In terms of animal protein availability, fish and fishery products contributes about 30 percent of the total animal protein intake. The said intake is significant because the majority of the consumers are relatively low- income earners who cannot afford other more expensive sources of protein. Currently there is a growing demand for fish created by increase in population growth estimated at 3.5 percent per annum.

The present potential yield is estimated at about 730 000 metric tonnes from both marine and freshwater fisheries. However, the present annual fish catch is estimated at about 350 000 metric tonnes suggesting that there is room for increased fish production.

Current data shows that certain traditional fisheries are either being fully or nearing full exploitation. These include Nile perch fishery from Lake Victoria and Prawn fishery from the coastline of the Indian Ocean. While efforts are being made to develop new fisheries in such areas as the Exclusive Economic Zone (EEZ), the currently exploited fisheries need to be managed wisely to sustain production and improve handling and processing to reduce fish post harvest losses in order to meet the needs of the growing population and future generations and in this way contribute to the national food security. This step is in line with the overall goal of National Fisheries Policy, which is *"to promote conservation, development and sustainable management of the Fisheries resources for the benefit of present and future generations"*.

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[166] The views expressed in this paper are solely those of the author, T.W. Maembe, Director of Fisheries, P .O. Box 2462 Dar-as-Salaam, Tanzania, E-mail: fisheries@twiga.com.

2. DESCRIPTION OF COASTLINE (MARINE WATER) AND THE PELAGIC LAKE VICTORIA FISHERIES

2.1 Coastline fisheries

Tanzania mainland has a coastline of about 800 km long of the Indian Ocean. The coast has a narrow steeply falling continental shelf. The fishing industry is mainly artisanal and fishing is concentrated close to the shore due to the limited range of the fishing craft at the disposal of the fishermen.

The marine fisheries support about 19 293 artisanal fishermen operating with a total of about 4 522 fishing vessels (mostly canoes) and landing an average of 61 241.17 tonnes of fin fish and about 1 173 tonnes of prawn per year. Both artisanal fishermen with poor fishing craft and industrial trawlers are harvesting the marine fisheries, especially the prawn fishery. The artisanal fishermen can only operate in the shallow waters less than three meters deep while trawlers can fish in areas from three meters or less to more than 20 meters deep.

Tanzania has prawn resources located in Rufiji delta, the Mafia channel, Ruvu, Wami and Pangani areas. Stock assessment conducted in 1990 has indicated that the maximum sustainable yield (MSY) of prawn resources is between 1 000 and 1 500 tonnes per year.

2.1.1 Factors contributing to un-sustainability and over-exploitation

The presence of prawn trawlers has increased the fishing effort and competition on exploiting the limited prawn resources. The artisanal fishermen have been marginalized to operate in shallow waters due to the fact that they operate with poor fishing vessels, mainly non- motorized canoes. Furthermore due to the increase in population the demand for prawn resources is increasing to meet the demand for domestic and foreign markets. The increase in demand would lead to increase of fishing efforts and fishermen would tend to use small mesh size nets to try to increase catches to meet the market demand but this will lead to over-harvesting of the stocks.

2.2 Nile perch fishery of Lake Victoria

Lake Victoria is a shared water body by the three riparian countries of Kenya, Uganda and Tanzania. The lake covers a surface area of 68 800 km^2 and an adjoining catchment of 184 000 km^2. The Tanzania sector of the lake covers approximately 51 percent while Uganda covers 43 percent and the rest 6 percent is on the Kenyan portion. The lake is of great value to the people of Tanzania and to their economic and social development. Fishery production from the Tanzanian side is about 170 000 tonnes annually, which is equivalent to 60 percent of the total inland production. The fishery of Lake Victoria provides food to more than four million people living in the Tanzanian catchment. About 55 985 full time fishermen operating a total of 15 434 fishing vessels and an estimated 500 000 people are employed formally and informally in fisheries related activities.

The total export of fish and fishery products from Lake Victoria for the last five years (1997 to 2001) was 172 359.7 metric tonnes valued at USD 343 428,141.5 (F.O.B value) of which the Fisheries Division received a total of Tshs 14.61 billion as Royalty. Biologically, Lake Victoria is of scientific interest as it harbours some endemic fish species. It is also an important source of water for domestic, industrial and agricultural use.

2.3 Factors contributing to unsustainability and overexploitation

The Lake is however, under intense pressure arising from human activities and natural processes. The lake has one of the fastest growing urban and a rural population in Africa. The multiple activities arising from this population has resulted into serious environmental problems. The most obvious one being poverty, declining water quality due to eutrophication, rapid disappearance of indigenous fish species, increase of fishing efforts, frequent fish kills, water hyacinth infestation and algae blooms. Water hyacinth infestation is interfering with fish breeding sites, landing beaches, lake transport and lake ecosystem. All these environmental threats may in the long run lead to a serious loss of income to the artisanal fishermen, loss of food/protein and loss of foreign exchange to the national economy.

The other factors contributing to unsustainability and overexploitation of prawn and nile perch resources include:

- pressure to increase prawn trawlers and nile perch processing plants leading to over capacity;
- lack of serious political commitment to responsible fisheries exploitation;
- fishing pressure caused by the increasing number of people seeking employment in fisheries as a way of reducing poverty;
- high demand for fish and fishery products by different markets;
- high prices offered for fish and fishery products.

3. MEASURES TAKEN BY THE GOVERNMENT

The Government has taken measures aiming at managing the prawn and Nile perch fisheries resources in a sustainable way, these include the following.

- Approval of a new Fisheries Policy (1997) with the main goal of ensuring responsible fisheries.
- Introduction of management of a closure period for three (months) from December to the end of February every year to allow the recruitment of the prawn fishery resources. There is also a closure period for six months in Lake Victoria for fish breeding and nursery areas.
- Preparation of a new Bill namely The Fisheries Act 2003 to accommodate the new Fisheries Policy and other international conventions on responsible fisheries.
- The introduction of an observer program on the prawn trawlers, to make sure that they abide to the Fisheries legislation.
- The riparian states of Lake Victoria have identified and agreed on areas for harmonization in the national fisheries legislation. Tanzania has incorporated these areas in the new Fisheries Bill after consultation with stakeholders in order to introduce co-management in Lake Victoria to ensure the fisher community plays a role to achieve responsible fisheries exploitation and management.
- The riparian states of Lake Victoria are implementing the slot size for Nile perch which is between 50 cm to 85 cm total length, to safeguard immature nile perch and the parent stock.

4. CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The increase of human population and poverty are the major factors contributing to un-sustainability and over exploitation of fisheries resources (natural resources). Unless the international community addresses these major factors the environmental degradation and loss of socio- economic gains would continue with significant negative impact to the people, particularly in third world countries.

4.2 Recommendations

The International community should support the national/regional programs on poverty alleviation; control of population growth; sustainable management of fisheries resources; and the environment.

FAO and the International Community should provide technical and financial support to strengthen national and regional capacity to implement the FAO code of conduct for responsible fisheries, the compliance Agreement, the International Plan of Action for the Management of Fishing Capacity and the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA – IUU).

ECUADORIAN FISHERIES

by

Rafael Trujillo[167]

Summary

This short document summarizes some factors of unsustainability and over-exploitation in coastal artisanal and oceanic purse seine tuna fisheries in Ecuador in recent years, within national and regional frameworks respectively.

1. INTRODUCTION

Fisheries are a very old activity in Ecuador. However, in the last 20 years it became a very important one socially and economically. Marine fisheries and aquaculture together are the second source of private exports in Ecuador. Total average catch in Ecuador is about 500 000 tonnes a year over the last decade, with an approximate value of one thousand million US dollars in exports, comprised of: 34.8 percent shrimp aquaculture; 32 percent canned tuna and small pelagics; 18.3 percent fish oil and flour; and 14.5 percent in fresh and frozen fish. There are an estimated 400 000 workers directly related to aquaculture and fisheries activities. Ecuador's population is 11.5 million.

Ecuador's fishery activity growth is due to private sector initiative, rather than to political planning. From my point of view, lack of interest in the last 20 years from the highest government spheres is due mainly to a very special circumstance. Ecuador, despite being a small country, is divided into two very well defined political and geographic zones: the mountains, where the capital Quito is located, and the coastal zone represented mainly by Guayaquil, the largest city and where the centre of industry and commerce is located. The country is politically driven from the capital in a very centralized way. Politicians and bureaucrats are traditionally careless about typical coastal production activities.

Despite the fact that several hundreds of million dollars come from fish and aquaculture exports, less than 0.05 percent is returned for research and fisheries administration. This is why growth of fishery activity is due mostly to the private sector's initiative rather than government's. The lack of money from the central government has partially been solved by self-administration fees.

My experience as former Sub-Secretary of Fisheries (an office that happens to be the only national jurisdiction government office out of the Capital), showed me very soon that we had to work alone, away from the central government, but co-managing fisheries with stakeholders.

After having made this introduction, I must say that although there are many other fisheries sub-sectors such as shrimp aquaculture, trawl prawn fleet, and longline oceanic fisheries, I will only focus this brief paper on two fisheries activities: the national coastal artisanal fishery, and the regional oceanic purse seine tuna fishery.

2. COASTAL ARTISANAL FISHERIES

There are in Ecuador about 60 000 artisanal fishermen and 16 000 boats. Approximately 66 percent of the boats are motorized. There are 138 fishing ports.

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[167] The views expressed in this paper are solely those of the author, Rafael Trujillo, Formerly Sub-Secretary of Fisheries, Guayaquil, Ecuador, rtrujillo@legalecuador.com.

In the last two decades, growth in artisanal fisheries was uncontrolled. In early 2000, a regulation banned construction and importation of all kinds of vessels, except to replace another vessel already authorized to fish. Hard work has been done in order to successfully control and make fishermen comply with this resolution in purse seine and long line tuna fleets, as well as in trawl prawn and small pelagic boats. However, compliance in the artisanal fisheries has been much more difficult. Because construction of artisanal boats is done along the entire Ecuadorian coast, and naval authorization is not required for these boats to go out and fish, it has been impossible to secure compliance with this regulation by the artisanal fleet.

Controlling the artisanal fleet is also the most difficult issue in other fisheries management measures adopted by the fishing authorities for several reasons: lack of other sources of work; lack of awareness in stakeholders about the necessity of adopting those decisions; and lack of enough inspectors to control compliance of so many fisheries participants. Because the government has no money to improve fisheries budget, and has never been able to offer alternative activities, especially in the case of closures, the Sub-secretariat of Fisheries decided that the best way to address some of these problems, was to implement a program of conservation and management seminars to artisanal fishermen since 2000. For the first time ever, the government paid attention to this kind of activity in the artisanal fleet. These seminars have included some elements of responsible fisheries contained in the FAO Code of Conduct, as well as training in technical fishery improvements. Hundreds of seminars have been given during 2000 - 2002.

Managing measures like shrimp closures in the last three years, total prohibition of prawn grub catching along the coasts; six month lobster closure; 45 days, twice a year, crab closures and other small pelagic and shell conservation measures were adopted in consensus with artisanal stakeholders and controlled in a relatively successful way. Monitoring, control and surveillance were also done in a co-participated manner with stakeholders.

3. OCEANIC TUNA PURSE SEINE FISHERIES

Tuna fisheries in Ecuador began in the 1940's, but it has only been since the early 1990's, when foreign and local tuna canneries were installed in the main fishery port of Manta and in Guayaquil, that spectacular growth occurred. Ecuador entered the Inter-American Tropical Tuna Commission (IATTC) in 1963 and left the organization in the late 60's because of difficulties in paying its financial contributions. It re-entered the IATTC in 1997, when industry fishermen realized that Ecuador could not stay out of this highly migratory species regional organization any longer. Industry also assumed the country's annual financial contribution.

The Ecuadorian tuna fleet has 83 vessels with a carrying capacity of more than 18 000 tonnes, excluding some 30 long line and cane vessels of not more than 2 500 tonnes.

IATTC, as the most important Regional Fisheries Organization (RFO) in the Eastern Pacific Ocean (EPO), despite normal problems, has been working quite well. IATTC is also the Secretariat of the International Agreement for the Dolphin Conservation Program (IADCP) signed in Washington in 1998.

In the last years, in IATTC we have taken important management measures to assure sustainability and stop over-exploitation of tuna species. Closures for big-eye and yellowfin tuna have occurred in the last years. Despite non-compliance with the measures by some individual stakeholders, in general there has been a good level of commitment, which should improve in the near future. However, as we will see in number 4, there is a very big concern with other level of none compliance issues.

One of the biggest challenges of IATTC is to try to stop the growing purse seine tuna fleet. It took more than two years to negotiate a definitive fleet moratorium resolution, which was adopted in June 2002 in Manzanillo, Mexico. Implementation of the resolution has begun in recent months. No new purse seine tuna vessel can enter into the tuna fishery in the Eastern Tropical Pacific Ocean, unless another one goes outside the EPO or has sunk. In this case, the replacement vessel's carrying capacity cannot be any larger that the replaced one. Quotas allocated on the basis of individual countries have been eliminated in favour of a regional register where listed vessels can move from one country to another. The resolution is far from perfect, but it has been a very good start to reducing fleet capacity in a few years to a recommended 135 000 tonnes, from more that 180 000 tonnes.

An example of another important management measure adopted has been prohibiting discards of fish at sea, which has been implemented in Ecuador and other IATTC participant countries.

All vessels more than 400 tonnes carrying capacity have an IATTC Observer on board. As IADCP statutes, member countries can also have their own Observer Programs to monitor up to 50 percent of fishing trips. Until now, four member countries have done so. Ecuador started its own Observer Program in year 2001, and currently successfully monitors 33 percent of Ecuadorian purse seine tuna vessel trips.

4. CHALLENGES IN IATTC

A major challenge that IATTC has in the future is how to deal with the absence of consequences for members and other participants' countries that do not implement measures adopted by the Commission. In 2000, an IATTC member country interpreted in a very original way the text of the resolution and decided not to implement the closure. In 2001, another member country alleging political reasons also decided not to comply. Finally in 2002, another observer country, with a very important fleet, officially decided, without a good reason, not to comply with the December closure approved in June's annual meeting. I must add that all these managing measures were adopted without objection by any of these countries.

An absence of sanctions or consequences to non-compliers will weaken this kind of organization, and it may lead to the disappointment of fishermen and governments from other countries to the extent that they would not support further management measures. If all participating countries do not comply with regional fisheries management measures, the rest of the countries will feel that their sacrifice is useless, and will stop supporting them. So this is likely to be the biggest challenge of RFOs such as IATTC in the near future.

The second biggest challenge is implementing the fleet capacity resolution, which is also linked with the concerns expressed above. All governments are under pressure from industry and boat owners, and if some countries comply with a moratorium and others don't, unless there are concrete sanctions or consequences, this and other conservation measures will be completely useless and could lead RFOs to disappear. There is no need to predict what could happen then with tuna managing.

5. CONCLUSIONS

Two specific actions that could help in a very positive way, fisheries management at national and regional levels would be:

- to encourage developed countries to give more financial and technical support to developing countries' local authorities to help control and organize adequately sustainable fisheries administration, support co-management as well as providing artisanal fishermen alternative activities, so conservation measures could be successfully implemented; and
- to encourage the international fisheries community to somehow address the issue of the urgent necessity for specific commercial consequences to non-complying countries, when dealing with measures adopted by RFOs.

This international workshop was organized to identify factors of unsustainability and overexploitation in fisheries and review major issues in the implementation of international fisheries instruments.

The workshop referred closely to the results of a first meeting held in Bangkok in 2002 (*The International Workshop on Factors Contributing to Unsustainability and Overexploitation in Fisheries*) but aimed more specifically at answering the following three important questions: What are the major obstacles to the implementation of key legal instruments? What are the main lessons learned and the possible paths to solutions for improved implementation? What are the possible gaps in these instruments impeding the international community from improving the management of marine fisheries?

The workshop was based on a review of eleven case studies, each relating to one of the following categories of fishery: large volume small pelagics; tuna and tuna-like species; large volume demersals; and coastal fisheries.

This publication contains the report of the workshop, discussion papers presenting case studies and notes submitted by participants. The document, and in particular the conclusions adopted by workshop participants, will serve as a basis for further analytical work aimed at improving fisheries management and a more effective implementation of major international fisheries instruments.

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